HOW TO ESTIMATE:

BEING

THE ANALYSIS OF BUILDERS' PRICES.

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GIVING FULL DETAILS OF ESTIMATING FOR EVERY CLASS OF BUILDING WORK, WITH THOUSANDS OF PRICES, AND MUCH USEFUL MEMORANDA

FOURTH EDITION, REVISED AND ENLARGED

WITH OVER 400 ILLUSTRATIONS

LONDON
B. T. BATSFORD, 94 HIGH HOLBORN

PREFACE

TO THE FOURTH EDITION.

THAT a fourth edition of "How to Estimate" should so soon become necessary is a sure sign of its utility, and in this issue the whole book has been thoroughly revised from beginning to end with great improvements and large additions, including many parts entirely re written, much original memoranda, important new tables, fresh examples of analysis, numerous additional illustrations, and the prices throughout overhauled, amounting in the aggregate to a tremendous advance on all the preceding editions put together Briefly, the present volume runs to about 530 pages and 400 illustrations, or 120 pages and 360 illustrations larger than the third edition and 200 pages greater than the first Notwithstanding these additions, my Publisher has decided to issue the new volume at the same price as formerly in the hope that a much larger sale will thereby be ensured

The more important of the alterations made may be summarised as follows In Chapter I sections inserted on Depreciation, Payment on Account, 20 per cent added for profit, establishment charges, and depreciation of plant and machinery instead of 15 per cent as formerly, and new Trade Abbreviations, &c Chapter II on the Cost of Buildings completely re written and extended to include External Services, 100 instead of 50 Brick Buildings, 50 Iron Buildings, Reinforced Concrete Buildings, Wooden Buildings, 170 Actual Costs of Buildings, Summary of Relative Costs, &c In Chapter III under Labour, descriptions of Methods of Payment, Electric Hoists, Electric Drills, Cutting Piles by Electricity, Cutting Metal with Oxygen, &c, have been appended In Chapter IV, Preliminary and Provisions, the latest scale of London Water Supply, and charges for special supplies for works, have

replaced the former rates The *Memoranda* relating to *Excavator, Concretor, Drainlayer, Pavior*, and *Zincworker* have been wholly re cast and enlarged with comprehensive tables, and portions added to the Memoranda of other trades Piling Memoranda, Large Earthworks, and Rock Dredging are embodied in "Excavator" An up to date section on Reinforced Concrete, with facts, figures, prices, and eighteen illustrations, is an interesting feature A table on the *Comparative* Value of Brickwork, memoranda, prices, and analysis of Terra cotta, and many other items, have improved "Bricklayer" Increases to the chapter on "Mason" are made under Comparative Labour, Circular Work, &c The section on "Pavior" has been redrafted to take in *modern Road Construction*, with 16 pages of practical memoranda never before published Latest specifications of Carpenter's and Joiner's Timber, as suggested by the editor of the *Timber News*, have found a place under "Carpenter and Joiner," as well as a useful Comparative Table of Prices Large diagrams of Steel Roof Trusses, with lists of spans, scantlings, weights, and costs, are now included in the chapter on Smith's work The chapter on "Plumber and Zincworker" has been split into two, dealing separately with each trade, the one on "Zincworker" being absolutely new, with memoranda, prices, and analysis "Gasfitter" analysis has been amplified, with many examples and sketches, and the Appendix still further extended

Altogether there are 40 extra analyses of prices and 360 additional illustrations, not to speak of innumerable minor improvements besides the larger ones mentioned. The labour of revision has been immense, extending over a long period, and as the author has worked single handed he hopes readers will be indulgent

Finally, it must be remembered that costs all round are higher, that there are no fixed standard prices, but that rates must always be built up in a natural way, according to the variable local conditions as pointed out in previous issues

January, 1913 J T. REA

PREFACE

TO THE FIRST EDITION.

ESTIMATING is undoubtedly the most important part of the builder's business. Many who tender make up their prices in a somewhat haphazard manner, often from published price books, aided by their own judgment and experience, and without a full knowledge of the scientific methods which underlie the formulating of a true estimate. These latter methods may be termed the analysis of builders' prices, which enables contractors to calculate values for themselves by dissecting, taking asunder, and examining the various elements that go to make them up, the complete result being shown in the priced bill of quantities.

The analysis of prices has not advanced much beyond where such men as Gauthey, Anselin, Nadaud, and Blottas left the matter many years ago. It is not proposed to make this a mere handbook on builders' prices, but it is intended to serve as an introduction to the *principles* upon which estimating is based rather than to set forth standard rates, which vary according to circumstances in every locality.

For the sake of uniformity, however, the author has endeavoured to approach London values; provincial prices are generally from 5 to 15 per cent less. In competitive tendering lower figures are often adopted.

The prices of most building materials have gone up from 20 to 30 per cent within the last few years, chiefly through

rings and corners, creating artificial values, but these frequently break down and counters resume their normal level. This constant fluctuation must be borne in mind in reading this book, for what may be right this week may be wrong next owing to a sudden change in the market. The mercurial discounts which merchants offer to contractors are alone sufficient to upset any trade list of prices, and builders wisely get quotations from time to time to ensure exactness, and these quotations vary in themselves according to the amount of the order and the standing of the customer, &c. The principles of estimating, however, still hold good as herein set forth.

The matter in this volume appeared originally as a series of articles in the *Building News*, but has been carefully revised prior to its publication in book form.

J. T. REA.

1st *October*, 1902.

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HOW TO ESTIMATE.

CHAPTER I.—INTRODUCTORY.

BEFORE a builder can tender properly, he must take many things into consideration, for if he is not careful a faulty estimate may mean a heavy loss and the decrease of his reputation. Low estimates, indeed, are often caused by an improper conception of what is required, and a loose consideration of the values of different features. The bills of quantities and every point in the plans and specification should be thoroughly examined, as well as the amount and class of work, and materials to be supplied Quotations for special parts should be obtained direct from the merchants The various markets ought also to be closely watched, so that the contractor may be quite up to date as regards the values of timber, metals, and other materials A weekly list of market prices is now inserted in all the technical journals

Within limits, it is best for a builder to obtain his materials from as few merchants as possible, such as builder's providers, as it saves trouble, lessens his accounts, and reduces

[illegible]

If the work is in a distant neighbourhood, a visit should first be paid to the place, and full information obtained as to the formation of the soil, the cost of cartage, railway rates, lime, sand, gravel, bricks, wages, &c

To be successful, a builder must strictly attend to his book-keeping, so that he can ascertain the profit and loss on various jobs, and such volumes as Debtors' Ledger, Day Book, Wages Book, Cost Book, Cash Book, Creditors Ledger, Extra Works Book, Jobbing Book, &c, should be kept Estimates ought always to be retained and put away, whether a job is secured or not, for they will be valuable for future reference;

and a builder should note each article sent to the ground or returned, and enter the cost opposite the item A correct account of all labour, and how spent, should likewise be kept, and most contractors, when they have ascertained by this means precisely how much certain work costs them, and the relation between estimated and actual cost, being the loss or gain on each item should make a record of it in their prime cost or other ledgers These accounts if framed on a correct basis and carefully worked out, form the most reliable data for future tenders

The variation in tenders for the same job is quite remarkable and this is particularly the case when builders take out their own quantities The chief explanation certainly lies in the fact that no proper system of estimating has been adopted, but that the clerk has probably relied upon a price book, and has concocted prices which are only empirical The object of this treatise is to show how to avoid such

by not allowing suffi

l checking quantities,

various parts of the

e time overestimating

ng part of the contract

by piecework local firms tendering against distant firms, certain work, such as joinery being prepared in the shop at a greater or lesser rate than on the job and having railway carriage to be added (in one case joinery prepared in London was fixed

total of jot

Looking

causes for extreme differences in estimating A contractor may be asked by a friendly architect to tender for an incon

if he cannot make any profit But if trade is good and the contractor has plenty of work he will sometimes tender at exorbitant rates for the sake of abnormal profits, and there is a little custom of putting very high figures to items which cannot be omitted, and low ones to others which are likely to be reduced, so that in the end only profitable work will be left Such trade practices are legitimate but cannot be reckoned in a price book

Builders' Price-Books

The published price books are naturally the first resort of the inexperienced estimator, but, as a matter of fact, the trade does not rely upon them for serious pricing They are no doubt compendiums of handy information connected with building, but the prices given are not always compiled in a scientific way For example, some of the prices include trade discount, some do not, while others are merely list prices from merchants' catalogues The discount in itself largely varies, and there are two discounts a trade discount and a discount for cash Moreover, the percentage of profit does not appear to be uniform, and the proportions of material and labour are not shown The diversities are innumerable, so that modifications to suit special cases are impossible

A builder's price is broadly made up of two things Material and Labour, to which may be added a third Profit. The cost of material and the cost of labour vary from time to time and from place to place, and do not fluctuate similarly Some prices being for material only and some for labour only, and the rest for both in varying proportions, a rise in wages must affect them very differently. The manual labour is often the most expensive item in a price, as it includes the preparation of the material and fixing

Besides mere material and labour, cartage and attendant labour, or cartage and scaffolding, should never be forgotten, as well as waste

From this it is obvious that a price book to be capable of adaptation must necessarily set out separately in each case the time occupied and the material consumed, or, which is the same thing, their values at stated rates It is, therefore, out of the question to set up a standard of prices suitable for every edifice, as there are so many points affecting the value of the work which must be taken into consideration, and the circumstances attending the erection of different buildings are rarely alike Such things as closeness or slackness of supervision misunderstandings as to quality of workmanship, worrying by the architect, delay in furnishing detail drawings, differences in locality and site frost and bad weather, sudden rises and falls in the markets, &c, will all help to alter the conditions of profit or loss for the contractor, and the extent of which no price book can measure

When, however, the builder has worked out a series of

prices for himself he must be on the alert for parallel cases to avoid the great labour involved in making calculations afresh every time a new estimate is made In fact he should carefully prepare an adaptable price book of his own, and revise it from time to time Thus a consistency in pricing would result which is of some consequence

It is needless to add that it is indispensable to have a large collection of trade catalogues and circulars in the office which should be frequently brought up to date

Prime Cost

The P C or net trade price of an article means the prime or net cost after deducting from the merchant s list price in his catalogue the trade discount But it does not include the discount for cash which
cash down nor carriage
definition of this expressi
with provisional amounts in bills of quantities as different interpretations are put upon it such as that the letters P C are intended to imply the published catalogue price This however is the list price or L P of the price list

Clause 27 of the R I B A Conditions of Contract states — The words Prime Cost or the initials P C applied in the specification to goods to be obtained and fixed by the contractor shall mean unless otherwise stated in the specification the sum paid to the merchant after deducting all trade discount for such goods in the ordinary course of delivery but not deducting discount for cash and such sum shall be exclusive of special carriage the cost of fixing and contractor s profit

After deducting the trade discount 10 per cent may be added for the contractor s profit but he frequently charges his clients the list price and takes his profit out of the trade discount

Discounts

As already stated there are two discounts a Trade Discount and a Cash Discount

The former is given by firms supplying building requisites
ies from 2½ to over
r cent is commonly
discount allowed by
with whom he deals

The discount for cash for quick payment for goods if paid

Profit

A net profit of 10 per cent is the least that builders like to accept, exclusive of establishment charges and depreciation, and is almost invariably added to each individual price. Therefore the total percentage to be added to each item of work, generally speaking, would be —

For establishment charges	5 per cent
For depreciation of plant and machinery	5 ,,
For profit on building work	10 ,,
Total	20 ,,

For work or material in small quantities, the profit should be higher, as the total expenditure in such a case is more in proportion. Therefore add 15 per cent profit on building work (or 25 per cent total, including 5 per cent for establishment charges and 5 per cent for depreciation), for small jobs, up to, say, £5,000

money, &c., when in the country. Thus, a workman may have

ard or a
working
ally turn
a bigger
builder.

The latter, indeed, scamps because that is his only means of keeping himself afloat and he cannot rival his more successful competitor. Dozens of similar doors and windows, and hundreds of feet run of moulded work in stone or wood, can be rattled out by machinery at comparatively little cost, and these, of course, are produced at a fraction of the rate of similar articles laboriously effected by hand labour. But in any case, experience and judgment are required before a

The common assumption that the bigger an order the less the charge, and the larger the quantity manufactured the cheaper to produce, does not always apply. For instance,

periods but it is safer to ignore such residue and assume complete decay

Payment on Account

The following is a specimen bill of payment on account in connection with an imaginary large contract —

Hotel at Blanktown

[illegible]

[illegible]		Amount [illegible]	Amount Total
		£ s d	£ s d
Amount of Contract			20 000 0 0
Total Reserve			2 000 0 0
Estimated value of Work to date at Contract rates		6 000 0 0	
Deduct Reserve 25 per cent		1 500 0 0	
		4 500 0 0	
Estimated value of material on site	£500 0 0		
Estimated value of plant on site	£400 0 0		
	900 0 0		
Deduct 50 per cent	450 0 0		
		450 0 0	
		4 950 0 0	
Deduct previous payments —	£ s d		
1st payment on 31 3 11	385 10 0		
2nd payment on 30 4 11	760 5 0		
3rd payment on 31 5 11	1 100 0 0		
4th payment on 30 6 11	1 304 5 0		
		3 550 0 0	
Total of 5th payment on account now submitted			1 400 0 0

Contractor's signature
J Smith
Date 31st July 1911

Architect's signature
C Wren
Date 1st Aug 1911

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out work more cheaply and expeditiously, and at a bigger profit to himself, than the small tradesman or jerry builder. The latter, indeed, scamps because that is his only means of keeping himself afloat, and he cannot rival his more successful competitor. Dozens of similar doors and windows, and hundreds of feet run of moulded work in stone or wood, can be rattled out by machinery at comparatively little cost, and these, of course are produced at a fraction of the rate of similar articles laboriously effected by hand labour. But in any case, experience and judgment are required before a

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	900 0 0		
Deduct 50 per cent	450 0 0		
		450 0 0	
		4 950 0 0	
Deduct previous payments —	£ s d		
1st payment on 31 3 11	395 10 0		
2nd payment on 30 4 11	760 5 0		
3rd payment on 31 5 11	1 100 0 0		
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For establishment charges	5 per cent
For depreciation of plant and machinery	5
For profit on building work	10
Total	20

For work or material in small quantities the profit should be higher as the total expenditure in such a case is more in proportion Therefore add 15 per cent profit on building work (or 25 per cent total including 5 per cent for establishment charges and 5 per cent for depreciation) for small jobs up to say £5 000

For jobbing and repairs a still larger percentage is required (even up to 20 or 40 per cent) to cover the time wasted in walking to and from the work small quantities of stuff more extensive supervision &c and for travelling expenses lodging

the remaining two thirds are thrown away on the road

The large contractor who perhaps owns a brickyard or a quarry in addition to extensive premises full of rapid working machinery and labour saving appliances can naturally turn out work more cheaply and expeditiously and at a bigger profit to himself than the small tradesman or jerry builder The latter indeed scamps because that is his only means of keeping himself afloat and he cannot rival his more successful competitor Dozens of similar doors and windows and hundreds of feet run of moulded work in stone or wood, can be rattled out by machinery at comparatively little cost and these of course are produced at a fraction of the rate of similar articles laboriously effected by hand labour But in any case experience and judgment are required before a

the Ipswich Town Council accepted a tender for 250,000 wood paving blocks, and were surprised to find a graduated rise in price per lot of 50,000, the first being cheapest. The explanation was that the merchants were unable to supply such a large number within a given time, while they found it comparatively easy to furnish 50 000 only Hence a smaller quantity was obtainable at a cheaper rate

Payment.

With reference to the terms of payment, it is considered that the larger and the more frequent the payments on account of contract the greater will be the facility with which the contractor can execute his work, and the lower will be his offer It practically means that he needs less capital to carry him on Payments are thus usually monthly The reserve to be deducted from each payment should never exceed 25 per cent on the value of the work executed, and is sometimes only 20 per cent The balance is paid several months after

Canal Rates

Water freights, whether by canal, river, or sea, are always lower than railway rates and whenever possible a smart contractor should take advantage of the former, even to the extent of chartering a boat himself and taking all his building materials as near as he can to a distant site in one cargo

Transport by canal is $\frac{1}{3}$ to $\frac{1}{2}$ cheaper than by railway, and the three principal causes are —*First* on a canal there is no item of cost corresponding with the wear and tear of rails, sleepers, or fittings though the cost of maintaining banks and locks must be taken into account *Second*, there is a corresponding saving of the repairs required by rolling stock and locomotives in consequence of their running on a rigid permanent way *Third*, the most important reason is that the maintenance of works on a canal is much less costly on an average than the corresponding outlay on a railway, not only from the absence of vibration, but also from the smaller magnitude of the works themselves

It is to be regretted, however, that these waterways have fallen into neglect and gradual decadence, and canal traffic seems to have declined in proportion to the development of railways. Perhaps this may be attributed to the slowness of transit and general inability to receive large barges, yet good canal systems, like those on the Continent, are of

undoubted benefit if properly managed The reasons for the lapse appear to be—(1) That the canals are owned in comparatively short lengths by independent companies each charging its own rate, and so introducing great confusion where long journeys are made, (2) That on all the most important canals some portions are invariably held by competing railway companies, in whose interest the rates at such points are always high (3) That the locks and water way vary greatly in size necessitating corresponding variation in the boats employed or on long voyages of the largest boats which can be used in the smallest canal *en route* (4) That canals seldom admit of steam haulage (5) That they are not always connected up with railways and (6) That the speed is only 2½ miles per hour as greater would cause wash and enormously increase cost of maintenance of the banks

A complete map of all the canals and inland navigations is embodied in the report of the Select Committee on Canals, May, 1883 Vol 13 Parliamentary Papers and a map is published by Messrs G Falkener & Sons of Manchester Among some of these may be mentioned the Midland Canal the Grand Junction Canal, the Regent's Canal the Grand Surrey Canal all of which are connected with London The canal system of the United Kingdom is 4 000 miles in length of which 1 300 miles are owned or controlled by the railway companies

The dues vary with the canal and the distance carried, as well as differing with the material The through rate between London and Liverpool is 4s 6d per ton for the total distance of 245 miles over nine different canals A common English rate is ½d per ton mile for horse haulage and 0·3d for steam haulage Canal wharfage charge 1½d to 3d per ton A usual rate for the discharge of cargo at a London canal wharf is 10s per day Canals carry by what they call gauge weight a most uncertain method—but efforts are being made to have such articles as bricks carried at computed weight as is now done by the railways

See the various reports of the Royal Commission on Canals, 1906 11

Railway Rates

A knowledge of railway rates is necessary for the contractor, for these must be generally added to the cost of the goods as quoted by the merchant Materials too, are often worked at the builders shops in town and have to be sent by rail to the site Things sent by rail are frequently

charged for at a higher rate than they should be and the amounts are paid because they are too complicated for most people to understand A little trouble will enable the prices to be checked and the cheapest way to forward different articles when considerable sums may be saved At every goods station a rate book is kept accessible to the public by Act of Parliament

Charges —These differ with the company, as well as with the classes of materials but the cost of conveyance is much less in proportion for long distances than for short ones The carriage of goods on railways to port of shipment in England is generalised at *1d* per ton per mile, though in Belgium and Germany only ½*d* per ton per mile The division of charges, and the modes of measurement of different comp n l ... ued For full list see the ... of Goods obtainable from ... company price 1*s* and published yearly by the Railway Clearing House Seymour St Euston Square London N W

Packing —Railway rates vary according to how articles are packed and if unpacked the owner often has to take the risk Allow 15 per cent of their cost for packing and carriage of stores in the United Kingdom

Description —In consigning goods full descriptions should be given as rates differ according to material Chimney pieces for example might be of slate marble wood or iron and the cost of carriage of each of these would be very different coming under different categories

Goods Trains —Articles go more cheaply by goods trains which are slower than by ordinary passenger trains and there are two rates one called company's risk under which the company is liable for damage and a lower rate called owner's risk under which the company is not so liable

In goods trains merchandise is divided into eight classes —A B C 1 2 3 4 and 5 The lowest rate is A gradually increasing to the highest 5 Classes A and B are for minerals &c in consignments of 4 tons and upwards, Class C for iron steel timber &c of 2 tons and upwards Goods in Class C under 2 tons are charged Class 1 unless the rate as for 2 tons at Class C is cheaper Classes A B and C do not include collection or delivery, but merely station to station

The rates 1 to 5 include collection and delivery within the usual boundaries, except local traffic on a few small lines

and where the trader or builder does his own carting a refund allowance is made from 1s to 2s 6d per ton This rebate must be claimed or it will not be paid How many contractors have hauled their stuff to the station for distant jobs and never known they were entitled to any cartage allowance?

Consignments of less than 3 cwt are charged under a Small Parcels scale which is higher in proportion to the tonnage rate Fractions of 14 lbs are charged as 14 lbs, and over 14 lbs as 1 qr Articles in different classes in the same package are rated at the charge for the highest

Owner's Risk —A reduced rate of 10 to 20 per cent can be obtained on certain goods if the sender forwards them at 'owner's risk' and signs the note thus relieving the railway company from ordinary carrier's risks but not from wilful breakage This reduced rate however is not allowed unless the goods fill a waggon load of 5 or 6 tons in one consignment as the risk of loss and error is much smaller than of small lots addressed to es are divided into three f damage and have x y eir class in the Extracts

Stable fittings iron or steel	3	about 10 per cent off
Glass flint	3 /	15
Marble chimney pieces packed	3	0

Special Rates —These are for different kinds of materials between certain stations under such generic terms as hardware &c The exceptional or cheaper rates are frequently fenced round with such conditions as owner's risk 4 ton lots 4 ton loads 2 ton lots station to station

c

accepted and signed for as damaged and a claim for the loss made on the railway company within two or three days

Not exceeding 25 miles 4d per cwt 50 miles 6d, 100 miles 10d 150 miles 1s 1d 200 miles 1s 4d, 250 miles 1s 7d 300 miles 1s 10d, 350 miles 2s and 400 miles 2s 3d per cwt Add 2d to above rates if coming to or going from a London station

B ..arra e p: .r rust be between the same persons and s .. ons as w n carried full by the railway collection and d l s - b r g included

Railway Wagons—These differ in size but the L N W Railway per 15 ft 6 in long × 7 ft 6 in wide × 1 ft 8 in high Sides of mineral trucks only 9 in high Load limit 8 or 10 tons but wagons are seldom fully loaded

Wagon demurrage charges beyond a reasonable period for the traders to load and unload may be taken at —

	Per day or part
F each wagon capacity not exceeding 16 tons	1s 6d
Di ex eed ng 16 ton and not exceeding 20 tons	2s 0d
30	3s 0d
30	5s 0d
D er a of shee s per sheet	3d

Builders Materials—The following are the classes of a few builders materials —

	Class
Beading and moulding gilt lacquered or varnished in boxes	3
B k common and fire	B
Builder implements such as barrows ladders winches pulleys &c	1
Cement	C
Chimney pots earthenware or fireclay in crates	C
Clay fire	A
Colours and paints in casks or iron drums or in tin cases	2
Drain pipes glazed	C
Felt asphalted	1
Glass sheet and rolled	2 y
Granite in blocks rough or undressed	B
Granite in blocks polished or dressed	1
Joiners work (common wood) beadings ... doors and door frames ... fixtures staircases balusters handrails ... and shutters	2 y
Laths wood in bundle	C
Lead piping in cases or casks	1
Lead sheet and white lead	1
Lime in bulk	B
Lime tone in bulk	A
Limestone polished or dressed	3
Ma ...	C
	C
	2 y
	B
	C
	B
	C
carved	2 y
decorative carved for the interior of buildings	4 y
Stoves grates or ranges common or kitchen	2 y
polished or enamelled not packed	3
packed	4

	Class
Timber (heavy woods at 40 cub ft per ton and light woods 50 cub ft.)	C
Varnish in casks or iron drums	2
Zinc sheets	C

For particulars of carriage of timber see "Carpenter and Joiner," under "Analysis"

Business Terms of Merchants

The following are the principal business terms and conditions of sale as usually set forth by merchants in their catalogues but they vary with the firm —

Prices and Delivery —The prices in this catalogue include (if a London firm) free delivery within town limits—i e Carter Paterson & Co's radius about ten miles from Goswell Road—to London wharves and railway companies' termini (It is frequently stated "Prices quoted are, unless otherwise specified at our works) They are subject to alteration without notice in the event of any particular rise or fall in the value of materials or labour

References —To prevent delay first order should be accompanied by remittance and in order to facilitate future business trade references should be given to well known firms in the United Kingdom (London houses preferred) before ledger accounts may be opened

Remittances —Remittances should be made payable to —— & Co and cheques crossed —— Bank

Terms —Accounts rendered monthly, payable during the month following, less 2½ per cent discount Quarterly and running accounts net Special prices for cash with order

Cash Discount —A discount of 2½ per cent will be allowed for cash if paid within one month from the date of invoice Prompt cash 5 per cent

Overdue Accounts —No discount whatever will be allowed off overdue accounts, which if not paid within three months or upon application will be charged with interest at the rate of 10 per cent per annum

Packing cases are charged extra for separately but two thirds are allowed for "empties" returned in good condition within 14 days from date of invoice carriage paid, and duly

advised The following are the usual prices inserted in invoices for packing cases —

		Per Ft Super
For large cases 1 in deal close		$3\frac{1}{2}d$
" "	open, skeleton or crate	$2\frac{1}{2}d$
$\frac{3}{4}$ in " close		$3d$
	open skeleton or crate	$2d$
Additional if [illegible] lined		$4d$

Breakage in Transit —Goods are sent forward at railway company's risk, and if damaged goods are returned for replacement, they must be returned by same carriers, marked "Carriage Free—Damaged in Transit" In the event of packages appearing, when delivered, to be in a damaged state, it is recommended that delivery notes be signed as "Contents Not Examined," as, in the event of damage, claims can be sustained if notice be given to carriers within 3 days of advice of arrival or delivery

Deficiencies All goods should be carefully examined on receipt and if any deficiency is detected it should be noted on the delivery sheet as the carriers will not be responsible unless the shortage is pointed out at time of delivery. The delivery of any goods properly addressed, to the carriers, will be considered as delivery to the purchasers

Errors No allowances for errors can be entertained unless advised within 14 days from date of invoice

Shipping Orders A *pro rata* charge of 5 per cent on the value of the goods is made on all shipping orders, to cover cost of packing and delivery to the docks in London If required to be delivered free on board ship in London, a further charge is made to cover shipping expenses, dock dues, cartage &c If the goods are shipped from any other port than London the cost of carriage to such port will be charged [illegible]

Special Quotations Where a quantity of goods of a similar description is required, a special quotation will be furnished on application

The trade discount, as a rule, is not publicly stated in catalogues but can only be obtained on private application Its amount [illegible]

and the larger [illegible]

Trade [illegible]

[illegible] used in [illegible]

[illegible] against all risks of Insurance

[illegible]

a/d	means	After date
A/o	,,	Account of
A/S	,,	Account Sales
B/E	,,	Bill of Exchange
B/L	,,	Bill of Lading
B/S	,,	Bill of Sale
Cent	,,	Centum (a hundred)
c & f	,,	Cost and Freight included in price
c i f		Cost, Insurance and Freight included in price
Co	,,	Company
C O D	,,	Collect (or Cash) on Delivery
Cr	,,	Creditor
c/s	,,	Cases
C W O		Cash with Order
cum div	,,	With dividend
d/d	,,	Days after date
do	,,	Ditto
Dr	,,	Debtor
d/s		Days after sight
d/y		Delivery
ea	,,	Each
E E		Errors excepted
E & O E		Errors and Omissions excepted
ex div		Without dividend
f a q		Fair average quality
f a s		Free alongside ship for seller; buyer puts them on board, and pays dues and charges
f o b	,,	*Free on Board*: the price quoted to include all the expenses of putting goods on board ship
f o r		Free on Rail, i.e. loaded into trucks
f o v	,,	Free on Van
f o w		First open water after winter ice (Baltic trade)
f o w		Free on wharf alongside ship
G M B		Good marketable brands
G O B		Good ordinary brands
I O U		I owe you
£ s d		Librae, solidi, denarii (pounds, shillings and pence)
Ltd		Limited
m/d		Months after date
m/s		Months after sight
M O		Money Order
N/A		No advice
No	,,	Numero (number)
%		Per cent
P/N		Promissory Note
P O	,,	Postal Order
P O O	,,	Post Office Order
Per cent	,,	By the hundred
per pro	,,	Per procurationem (by procuration)
Pro rata	,,	In proportion
Pro tem	,,	Pro tempore (for the time being)
Prox	,,	Proximo (next month)
P S	,,	Postscript to a letter

CHAPTER II.—THE COST OF BUILDINGS.

THERE are five methods of ascertaining the value of buildings before erection as follows —

I Per Unit
II Per Foot Cube
III Superficial Method.
IV Rough Quantities
V Accurate Quantities.

I *Per Unit*—Pricing at per unit of accommodation is a rough and ready means of jumping at the cost of such buildings as churches, hospitals, schools, stables, and other edifices, which may be respectively priced at per sitting, per patient, per scholar, and per horse Its great handiness is that the value can be at once roughly determined without preparing troublesome drawings

II *Per Foot Cube*—This is the best known and most usually adopted because of its general convenience The dimensions are taken from the plans, by measuring the length and breadth from out to out of walls, and the height from half foundations (*i e* bottom of footings or top of concrete) to half way up roof Include chimney-stacks and dormers if large but exclude buttresses, pilasters, and small projections The cubic contents thus obtained are multiplied by the price per foot cube of some similar building Cheaper attached structures such as outhouses, sheds, verandahs, &c, should be kept separate and monied at a lower rate; while more ornamental portions, like porches and towers, would be valued higher than the main block Small buildings cost more in proportion than large ones of the same type

The cubic system, however, is objectionable because it lumps voids and solids, the proportions of which vary in different buildings, at one rate

III. *Superficial Method*—This comprises three sub-heads —

(a) *Floor Areas* The floor areas of the various rooms, passages, stairs, &c, of a building are measured, ⅓th is added to the totals for walls and waste, and then the different

apartments are priced at so much per square of 100 ft. sup. noting height of each story

	£		£	
Principal rooms	40	to	60	per square
Secondary rooms	30		40	"
Domestic offices	20		30	"

(*b*) *Plinth Area* Chiefly applicable to one-story buildings, and much used in India. Rate is at per square foot or per square of 100 ft. sup. Foundations and roof are included in cost. If there are two or more stories, different values may be taken for each, the ground floor (which includes foundations) being the most expensive.

(*c*) *Vertical and Horizontal Squares* This mode is to take the constructional shell only, rating it at so much per square of 100 ft. sup. Walls, for instance, are taken according to

reckoned at per square complete. A special list of prices must be compiled for each collected area, and for every class of work, making this method too tedious.

IV *Rough Quantities.*—The measurements should be concentrated into as few items as possible to save labour, and a schedule of prices or a special table of grouped costs would be necessary to money these out. Brickwork, for

and "Billing" the last only being given to the contractors for inserting their prices, when the completed bills are sent to the architect for his and his clients' decision.

EXTERNAL SERVICES

When preparing approximate estimates, in addition to the

cost of the building only add the accompanying for outside expenses —

		Per cent	
	lary		
		20	
Contractor's Work		5	
	jobs		
	(10 per cent)	5	
			% 30
Professional Work	Legal charges say	3	
	Purchase or survey of site say	5	
	Architect's commission	5	
	Quantity surveyor's fee	1½	
	Clerk of works £3 a week say	1½	
	Furniture and fittings	4	
			20
	Total extraneous expenses		50

Foregoing are merely approximate as external services are very variable depending on so many factors From above they would appear to roughly cost half as much again as the building itself

Examples of Estimates

Approximate Estimate —The outline example below will indicate how the approximate estimate for an ordinary building is summed up —

	£
Main block 132 500 ft cube at 9*d* per f c	4 970
Tower attached 16 480 ft cube at 1*s* 6*d* per f c	1 236
Outbuildings 54 900 ft cube at 6½*d* per f c	1 487
Buildings only	7 693
Add 20 per cent for site roads paving drainage water supply	1 539
	9 232
Add 5 per cent for contingencies on foregoing	462
Total estimate for builder's work	£9 694

Say in round figures £9 700 Add charges for professional work, furniture and fittings &c about another 20 per cent

Actual Estimate —The following is the actual approximate estimate of the Horton Lunatic Asylum as submitted in March 1903, by the Metropolitan Asylums Board to the London County Council It is very instructive as showing

how the cost of an immense modern building group is made up —

	£
Foundations	55 710
Superstructure	320 860
Water and gas mains	2 200
Roads	10 000
Fencing	6 000
Airing court shelter and tar paving	5 930
Boilers and heating system	25 400
Laundry machinery	6 000
	4 000
	11 000
	800
	6 500
Farm buildings	15 000
Architect and quantity surveyors	13 000
Clerk of works extras and contingencies	13 600
	496 000
Equipment of asylum	55 000
Additional work to central station	10 000
New well &c	8 500
Total estimate	£569 500

Estimated Cost of Buildings
Brick Buildings

The succeeding average rates are based on actual costs and are for brick buildings erected under ordinary conditions, stone structures cost 10 to 20 per cent more according to locality Prices are exclusive of land sites roads fences professional fees furnishing plant machinery &c, except where otherwise stated —

No	B[illegible]	Per Ft. Cube	Per Unit
1	Abattoirs [illegible]r slaughter houses with fittings	6d to 9d	—
2	Alms houses	6d to 8d	—
3	Art or picture galleries public	9d to 1s	—
4	[illegible]	8d to 10d	—
[illegible]	[illegible]	[illegible]d to 10d	—
[illegible]	[illegible]	[illegible]d to 10d	£200 to £300 per inmate
	Furniture and fittings for ditto	—	£20 to £30 per inmate
7	Banks with fittings	9d to 1s	—
8	Bakeries including ovens &c	7d. to 9d	—
9	Barns forage	4d to 6d	£2 to £3 per horse
10	Barracks complete set for battalion of infantry including officers, men's and married quarters, accessory buildings lighting water supply drainage roads parades &c Total £130 000	7d to 10d	£150 to £1[illegible]0 per male.

	Building	Per Ft Cube	Per Unit
11	Barracks officers quarters and mess	8d to 11d	£700 to £900 per officer
12	Barracks men s blocks	5d to 8d	£30 to £40 per man
13	Barracks, married soldiers quarters	8d to 11d	£300 to £400 per quarter
14	Baths public, excluding heating machinery and boilers (2d per f c)	8d to 11d	—
15	Breweries about three stories and cellar including plant machinery and well but exclusive of sheds, boundary walls gates &c —		
	[illegible] ..		[illegible] per qtr
	..		
	..		[illegible] ,
	..		[illegible] ,
	..		[illegible] ,
			,
	(Note — Quarters of a brewery or a malting mean that the kiln treats so many quarters of barley from which malt is made, at one operation A quarter = ¼ tun = 8 bushels of malt = 10 to 12 ft cub)		
16	Bungalows one story	6d to 8d	£40 to £60 per square
17	Chapels plain including spire seating &c	5d to 8d	£4 to £8 per sitting
18	Churches including tower and seating	6d to 10d	£8 to £15 per sitting
19	Club buildings town	8d to 1s	—
20	Coach houses apart from stables	4d to 6d	£50 to £100 per coach
21	Coal stores and yards	3d to 4d	£2 to £4 per ton
22	Colleges including accessory buildings	8d to 11d	£100 to £200 per scholar
23	Convenience public, underground	3s to 4s	£50 to £80 per compartment
24	Cottages labourers £15 to £200 each	4d to 6d	£40 to £50 per room
25	Cowhouses or byres including fittings	4d to 6d	£15 to £30 per stall
26	Crematorium buildings with furnaces	1s to 2s	£15 to £30 per sitting
27	Dairies exclusive of machinery	5d to 8d	—
28	Distilleries whisky or other spirit (reckoned at per 1 000 gals output capacity per annum)	4d to 7d	£100 per 1 000 gals output
	Fixed plant for ditto	—	£90 per 1 000 gals output
29	Drill halls closed	3d to 5d	£25 to £35 per square

No	Building	Per Ft Cube	Per Unit
30	Factories exclusive of machinery	4*d* to 7*d*	—
31	Farm buildings including farmhouse	4*d* to 8*d*	£5 to £8 per farm acre
32	Fire stations with firemen's quarters	7*d* to 10*d*	—
33	Fives courts (4*s* to 5*s* per ft sup)	—	£100 to £130 each
34	Flats residential first class	1*s* to 1*s* 3*d*	£100 to £[illegible]00 per room
35	Gymnasia including fittings	5*d* to 7*d*	—
36	Homes for children nurses &c with laundry infirmary and accessories	8*d* to 10*d*	£150 to £300 per occupant
37	Hospitals cottage isolation	8*d* to 10*d*	£200 to £350 per bed.
38	Hospitals fever or infectious including administrative and accessory buildings	10*d* or 1*s*	£350 to £500 per bed
39	Hospitals general including administrative and accessory buildings	9*d* to 11*d*	£300 to £450 per bed
	Furnishing ditto furniture beds &c	—	£10 to £20 per bed
40	Hospitals military general	8*d* to 10*d*	£300 to £400 per bed
41	Hotels first class	1*s* 3*d* to 1*s* 6*d*	—
42	Hotels second class	10*d* to 1*s* 2*d*	—
43	Houses or mansions first class	1*s* to 1*s* 3*d*	£200 to £400 per room
44	Houses or mansions second class	8*d* to 11*d*	£100 to £170 per room
45	Houses or villas third class	5*d* to 8*d*	£60 to £80 per room
46	Houses out buildings and offices	4*d* to 7*d*	£40 to £50 per room
47	Huts one story for men	4*d* to 7*d*	£15 to £25 per man
48	Hydropathic establishments	9*d* to 1*s* 2*d*	—
49	Infirmaries workhouse including administrative buildings &c	[illegible] to 9*d*	£100 to £[illegible]50 per bed
50	Laboratories chemical and physical	8*d* to 11*d*	£300 to £400 per pupil
51	Laundries and wash houses ordinary	8*d* to 11*d*	£30 to £50 per trough
52	Laundries steam including plant and machinery complete	10*d* to 1*s*. 2*d*	£40 to £[illegible]0 per trough
53	Lavatories first class	9*d* to 1*s*	£10 to £20 per basin
54	Law courts or sessions houses	10*d* to 1*s* 2*d*	—
55	Libraries public	7*d* to 10*d*	5*s* to 10*s* per volume
56	Maltings including plant and machinery	2*d* to 5*d*	£60 to £80 per quarter
57	Market halls	5*d* to 8*d*	£[illegible]0 to £150 per square
58	Mills exclusive of machinery	4*d* to 7*d*	—
59	Mission halls	4*d* to 6*d*	£4 to £6 per sitting
60	Mortuaries or dead houses	9*d* to 1*s*.	—

No	Building	Per Ft Cube	Per Unit
61	Municipal buildings	10*d* to 1*s* 3*d*	—
62	Municipal lodging houses and furnishing	8*d* to 10*d*	£50 to £70 per bed
63	Museums public	10*d* to 1*s*	—
64	Music halls	9*d* to 1*s*	£10 to £20 per seat
65	Offices city best class	11*d* to 1*s* 2*d*	£150 to £250 per office
66	Parish halls	6*d* to 8*d*	£3 to £5 per sitting
67	Police stations and barracks	7*d* to 10*d*	£160 to £170 per man
68	Post offices	8*d* to 10*d*	—
69	Power and electric stations exclusive of plant and machinery	6*d* to 8*d*	£10 to £20 per kilowatt
70	Prisons complete	8*d* to 1*s*	£120 to £180 per cell
71	Public buildings of various kinds	1*s* to 1*s* 6*d*	—
72	Racquet courts with accessory rooms	5*d* to 7*d*	£1 000 to £2 000 each
73	Reformatories inebriates	8*d* to 10*d*	£300 to £500 per bed
74	Riding schools	3*d* to 5*d*	—
75	Sanatoria for consumptives	9*d* to 1*s*	£300 to £600 per bed
76	Schools Board London school buildings only	7*d* to 9*d*	£10 to £15 per scholar
	Ditto including special and subsidiary buildings drainage play grounds boundary walls school keeper's house &c	8*d* to 10*d*	£15 to £25 per scholar
	Furniture and fittings for ditto	—	10*s* to 20*s* per scholar
77	Schools Board provincial school buildings only	5*d* to 7*d*	£7 to £12 per scholar
	Ditto including special and subsidiary buildings drainage play grounds boundary walls sheds &c	6*d* to 8*d*	£10 to £20 per scholar
	Installing mechanical ventilation	—	30*s* to 40*s* per scholar
78	Schools infants military	7*d* to 10*d*	£15 to £20 per scholar
79	Schools secondary day or higher grade including laboratories play sheds and boundary walls &c	8*d* to 11*d*	£30 to £60 per scholar
80	Schools sunday, class rooms and hall	4*d* to 7*d*	£4 to £7 per scholar
81	Sheds closed cattle	4*d* to 7*d*	£20 to £30 per bullock
82	Sheds engine cart or wagon	4*d* to 6*d*	£20 to £30 per wagon
83	Shops first class for cities	9*d* to 1*s*	—
84	Shops second class for towns	7*d* to 10*d*	—
85	Soldiers and sailors institutes	6*d* to 9*d*	£10 to £50 per man

No	Building	Per Ft Cube	Per Unit
86	Stables first class including cavalry officers	9d to 11d	£100 to £150 per stall
87	Stables second class including cavalry troop	6d to 8d	£70 to £100 per stall
88	Stables third class including farm	5d to 7d	£50 to £70 per stall
89	Stores clothing equipment utensils &c	5d to 7d	—
90	Technical colleges or institutes	8d to 11d	£30 to £60 per pupil
91	Tenements or artisans dwellings London	8d to 10d	£70 to £110 per room
92	Tenements or artisans dwellings provincial	5d to 8d	£60 to £90 per room
93	Theatres first class	1s to 1s 3d	£20 to £30 per seat
94	Theatres second class	9d to 1s	£10 to £20 per seat
95	Town halls exclusive of towers	10d to 1s 4d	—
96	Towers to ditto	1s 6d to 2s	—
97	Warehouses plain	6d to 9d	—
98	Water towers exclusive of tanks and pipes	1s to 1s 4d	2s to 5s per gal
99	Workhouses including administrative and accessory buildings	7d to 10d	£1[illegible]0 to £2[illegible]0 per inmate
100	Workshops artificers	6d to 8d	£40 to £50 per square

Iron Buildings

[illegible]

foundations floors heating drainage water supply, &c add 10 to 20 per cent

No	Building	Per Ft Cube	Per Unit
1	Asylums including accessory buildings	3d to 5d	£50 to £100 per inmate
	Equipment of ditto	—	£10 to £20 per inmate
2	Bandstands octagonal	4d to 5d	£150 to £300 each
3	Barns fodder	2d to 4d	2s to 3s per ft sup
4	Bungalows 4 to 8 rooms	3d to 4d	£100 to £300 each
5	Chapels including seating (3s to 4s per f s)	3d to 5d	£1 to £3 per sitting
6	Churches including seating (3s to 4s per f s)	3d to 5d	£2 to £3 per sitting
7	Coal stores and yards	2d to 4d	£1 to £3 per ton
8	Cottages 2 to 6 rooms	3d to 5d	£80 to £200 each

No.	Building	Per Ft. Cube.	Per Unit.
9	Drill halls, closed	3*d* to 4*d*	2s to 3s per ft sup
10	Engine sheds	2*d* to 4*d*	£30 to £40 per engine
11	Exhibition buildings steel wood and plaster	1*d* to 2 *d*	2s to 6s per ft sup
12	Farm buildings	3*d* to 4*d*.	1s to 2s per ft sup
13	Granaries	2*d* to 4*d*	2s to 3s per ft sup
14	Gymnasia including fittings	3*d* to 4*d*	2s to 3s per ft sup
15	Hospitals, 4 to 40 beds 100 f s per bed	3*d* to 5*d*	£50 to £150 per bed
16	Houses 2 to 8 rooms (3s to 4s per f s)	3*d* to 5*d*	£100 to £350 each.
17	Huts for men	3*d* to 5*d*.	£10 to £20 per man
18	Lecture halls	3*d* to 4*d*	£1 to £2 per sitting
19	Manges covered	1*d* to 2*d*	2s to 3s per ft sup
20	Market hall	3*d* to 5*d*	3s to 4s per ft sup
21	Mission halls furnished (3s to 4s per f s.)	3*d* to 5*d*	£1 to £3 per sitting
22	Pavilion stands 1 story	3*d* to 4*d*	£1 to £2 per seat
23	Porches, iron and glass for entrances to theatres hotels &c. 16 ft long	—	£70 to £100 each
24	Roofs corrugated iron exclusive of iron or steel trusses 18 to 22 gauge	—	£2 to £3 per square
25	Roof ordinary steel and iron with trusses	—	1s to 2s per f s covered.
26	Roof railway station platform with glass	—	2s to 3s per f s. covered.
27	Roofs railway station termini over 150 ft span fixed complete	—	£30 to £40 per square
28	Roof trusses delivered only for galv iron.	—	4s per ft. of span
29	Roof trusses delivered only for slates	—	8s per ft of span
30	Sanatoria for consumptives	3*d* to 5*d*	£80 to £150 per bed
31	Schools 50 to 200 children with class-rooms only	3*d* to 4*d*	£ to £4 per scholar
32	Schools, 50 to 200 children with accessories	4*d* to 6*d*	£4 to £6 per scholar
33	Sheds out houses &c closed	3*d* to 4*d*	2s to 3s per ft sup
34	[illegible] open	2*d* to 3*d*	1s to 2s per ft sup
35	Stables [illegible]	3*d* to 4*d*	2s to 3s per ft sup

No.	Building	Per Ft Cube	Per Unit
36	Smitheries including fittings	2d to 4d	1s to 3s per ft sup
37	Stables first class, with coach house	4d to 5d	£30 to £50 per stall
38	„ second „ „ „	3d to 4d	£20 to £30 per stall
39	Stable iron fitments manger hay rack chains corn bins &c and fixed	—	£5 to £25 per set
40	Staircases, cast iron spiral 5 ft diam	—	30s per foot rise
41	„ „ 4 ft „	—	20s per foot rise
42	Stairs, iron superior with balusters 2 ft wide	—	30s per foot rise
43	Stairs iron superior double landings for ditto	—	£5 to £7 each
44	Stores of various sorts	2d to 4d	2s to 3s per ft sup
45	Tanks cast iron, 5 000 to 10 000 gals	1s 6d to 2s	3d to 4d per gal
46	„ wrot iron „	2s 0d to 2s 6d	4d to 5d per gal
47	Warehouses closed	2d to 4d	2s to 3s per ft sup
48	„ open	2d to 3d	1s to 2s per ft sup
49	Warming apparatus complete with boiler, hot water pipes radiators &c	—	£1 to £4 per 1,000 fo of contents of room
50	Workshops engineering	2d to 4d	2s to 3s per ft. sup

Cost by Weight —The iron and steel alone will cost £11 to £13 per ton, or 1¼*d* per lb , delivered

Reinforced Concrete Buildings

[illegible] lumns, beams, wall or floor of which *add* to 6*d* per ft cube of building

1	4 to 8 story buildings of domestic or office type	1½*d* to 2½*d*	per ft cub
2	4 to 8 story buildings of warehouse or public building type	1¾*d* to 3*d*	„ „
3	Cost of steel framing alone according to site	1*d* to 2*d*	„ „
4	Flooring extra to foregoing	4s to 8s	per yd sup

The general economy in construction for large structures is 20 to 30 per cent , but for small buildings inconsiderable

No	Building	Per Ft Cube	Per Unit
9	Drill halls, closed	3d to 4d	2s to 3s per ft sup
10	Engine sheds	2d to 4d	£30 to £40 per engine
11	Exhibition buildings steel wood and plaster	1d to 2½d	2s to 6s per ft sup
12	Farm buildings	3d to 4d	1s to 2s per ft sup
13	Granaries	2d to 4d	2s to 3s per ft sup
14	Gymnasia including fittings	3d to 4d	2s to 3s per ft sup
15	Hospitals 4 to 40 beds 100 f s per bed	3d to 5d	£50 to £150 per bed
16	Houses 2 to 8 rooms (3s to 4s per f s)	3d to 5d	£100 to £350 each
17	Huts for men	3d to 5d	£10 to £20 per man
18	Lecture halls	3d to 4d	£1 to £2 per sitting
19	Maneges covered	1d to 2d	2s to 3s per ft sup
20	Market halls	3d to 5d	3s to 4s per ft sup
21	Mission halls furnished (3s to 4s per f s)	3d to 5d	£1 to £3 per sitting
22	Pavilion stands 1 story	3d to 4d	£1 to £2 per seat
23	Porches iron and glass for entrances to theatres hotels &c 16 ft long	—	£70 to £100 each
24	Roofs corrugated iron exclusive of iron or steel trusses 18 to 22 gauge	—	£2 to £3 per square
25	Roofs ordinary steel and iron with trusses	—	1s to 2s per f s covered
26	Roofs railway station platform with glass	—	2s to 3s per f s covered
27	Roofs railway station termini over 150 ft span fixed complete	—	£30 to £40 per square
28	Roof trusses delivered only for galv iron	—	4s per ft of span
29	Roof trusses delivered only for slates	—	8s per ft of span
30	Sanatoria for consumptives	3d to 5d	£80 to £150 per bed
31	Schools, 50 to 200 children with class rooms only	3d to 4d	£[illegible] to £4 per scholar
32	Schools 50 to 200 children with accessories	4d to 6d	£4 to £6 per scholar
33	Sheds out houses &c closed	3d to 4d	2s to 3s per ft sup
34	open	2d to 3d	1s to 2s per ft sup
35	Skittle alleys	3d to 4d	2s to 3s per ft sup

No.	Building	Per Ft Cube	Per Unit
36	Smitheries including fittings	2*d* to 4*d*	1*s* to 3*s* per ft sup
37	Stables first class with coach house	4*d* to 5*d*	£30 to £50 per stall
38	,, second ,, ,,	3*d* to 4*d*	£20 to £30 per stall
39	Stable iron fitments manger hay rack chains corn bins &c and fixed	—	£5 to £25 per set
40	Staircases cast iron spiral 5 ft diam	—	30*s* per foot rise
41	,, ,, ,, 4 ft	—	20*s* per foot rise
42	Stairs iron superior with balusters 2 ft wide	—	30*s* per foot rise
43	Stairs iron superior double landings for ditto	—	£5 to £7 each
44	Stores of various sorts	2*d* to 4*d*	2*s* to 3*s* per ft sup
45	Tanks cast iron 5 000 to 10 000 gals	1*s* 6*d* to 2*s*	3*d* to 4*d* per gal
46	,, wrot iron ,,	2*s* 0*d* to 2*s* 6*d*	4*d* to 5*d* per gal
47	Warehouses closed	2*d* to 4*d*	2*s* to 3*s* per ft sup
48	,, open	2*d* to 3*d*	1*s* to 2*s* per ft sup
49	Warming apparatus complete with boiler hot water pipes radiators &c	—	£1 to £4 per 1 000 f c of contents of room
50	Workshops engineering	2*d* to 4*d*	2*s* to 3*s* per ft sup

Cost by Weight —The iron and steel alone will cost £11 to £13 per ton, or 1½*d* per lb , delivered

Reinforced Concrete Buildings

[illegible] columns, beams, wall or floor of which *add* to 6*d* per ft cube of building

1	4 to 8 story buildings of domestic or office type	1¼*d* to 2¼*d* per ft cub
2	4 to 8 story buildings of warehouse or public building type	1¾*d* to 3*d* ,, ,,
3	Cost of steel framing alone according to site	1*d* to 2*d* ,, ,,
4	Flooring extra to foregoing	4*s* to 8*s* per yd sup

The general economy in construction for large structures is 20 to 30 per cent , but for small buildings inconsiderable

Wooden Buildings

Wooden framing, covered with weather boarding outside and lined inside, wooden floors and roofs, latter covered with felt ruberoid, or corrugated iron, buildings including concrete foundations brick bases, and brick chimney shafts. Figures below are based on actual costs

1	Churches plain without towers or spires	3d	per ft	cub
2	Cottages 2 storie 6 rooms	3½d	„	„
3	Farm building 1 story for stables byres shed hay &c	2d		„
4	Huts 1 story comprising 1 large living room	3¼d	„	
5	Hut 1 story superior with 8 living rooms each	6d	„	„
6	Reading rooms 1 story	5d	„	„

Actual Cost of Buildings

The following list showing the actual cost of buildings as erected exclusive of land will be useful for the purposes of comparison —

Abattoirs

No	Building	Per Ft. Cube	Per Unit
1	Abattoir Aldershot (1902) 50 bullocks 160 sheep Bk walls iron and slated roof conc floors Total £6 500	6¼d	£31 per animal

Asylums

No	Building	Per Ft. Cube	Per Unit
2	Claybury Asylum London (1893) 2 158 inmates	—	£[illegible]36 per inmate
3	Winwick Asylum Warrington (1901) 2 000 inmates Bk walls water tower church cottages gate lodges electric lighting &c Total £583 000	—	£[illegible]91 „
4	York Asylum (1903) 360 inmates Total £90 500	—	£2[illegible]0 „
5	Temporary buildings (1896) at Colney Hatch Asylum. 300 inmates. Wood and corr iron on brick foundations with hot water pipes boiler house offices &c Total £18 000	—	£60 „
	Equipment of ditto £3 600 in addition	—	£12 „

Bakeries

No	Building	Per Ft. Cube	Per Unit
6	Bakery Aldershot (1903) 3 stories 21 000 2 lb loaves in 7 hrs. Bk walls iron and slated roof special ovens &c Total £23 100	7½d	£1 2s per loaf
7	Bakery, Curragh (1884 6) 2 stories Bk walls slated roof large ovens tall chimney stack Total £4 030	7¼d	—

Barns

No.	Building	Per C. Ft. Cube	Per Unit
8	Forage barn, [illegible] (190[illegible]) 14 days forage and straw for 62) horses. Bk walls, slated roofs. Total £1,6[illegible]	[illegible]	£2 per horse
9	Forage barn, [illegible] (1901) 3,000 tonnes hay, [illegible] tonnes straw, 900 sacks oats. Bk walls, stone dressings, slated roof. Total £[illegible]	[illegible]	[illegible] per tonne

Barracks

No.	Building	Per C. Ft. Cube	Per Unit
10	General's Quarters, [illegible] 2 stories. Bk walls, slated roof, wooden stairs &c.	[illegible]	—
11	Officers' mess and quarters, Curragh (1902—4) 2-story block, 31 officers, 80 rooms. Bk walls, slated roofs, wooden stairs, &c. Total including out buildings, roads, drainage, water supply, &c., £19,000	10 [illegible]	£[illegible] per officer
12	Officers' quarters, Shorncliffe (1900). 2-story block, 23 officers. Bk walls, slated roof, wooden stairs, &c. Total £16,2[illegible]	[illegible]	£[illegible] ,,
13	Men's blocks, Aldershot (1903). Half company blocks. Bk walls, slated roofs.	[illegible]	£31 per man
14	Men's blocks, Caterham, London (1900). Double company and single company 2-story blocks. Bk walls, slated roofs.	6d.	£34 ,,
[illegible]	[illegible]	7d.	£41 ,,
[illegible]	[illegible] block. £4,000	11½d.	£383 per qr.
17	Married soldiers' quarters, Curragh (1902—4). Cottage type, 2 stories, 10 to 20 quarters per block, with porch and yard &c. Bk. walls, slated roofs		
	Buildings only	9½d	£370 per qr
	Forming site, roads, drains, water supply, &c	—	£50 per qr
	Total buildings and forming site, &c	11d	£420 per qr
18	Married soldiers' quarters, Shoeburyness (1899). 2 stories. Bk. walls, slated roofs	8d	£310 per qr

Baths

No.	Building	Per C. Ft. Cube	Per Unit
19	Public Baths, Caledonian Road, Islington, exclusive of machinery and boilers (2d per f.c.)	8d	—
20	Public Baths, Tibberton Square, Islington, ditto	9d	—
21	Public Baths, Hornsey Road, London, N., ditto	8½d	—

Chapels, Nonconformist

(Cost includes tower, spire and seating)

No	Building	Per Ft Cube	Per Unit
22	Algernon Road Lewisham London, S E, 310 sittings Bk walls, stone dressings, tiled roof	5½d	£3 17s 6d per sitting
23	Bourton-on the Water 320 sittings Rubble walls brick lining and arches, stone piers and tracery	5¼d	£5 12s 6d per sitting
24	Dulwich Grove London, S E, 570 sittings Bk walls stone tracery wooden columns inside tiled turret	5¾d	£6 3s 10d per sitting
25	Jesmond Newcastle 550 sittings Stone walls nave piers and moulded arches stone pulpit, marble baptistery roof carried by cross arches of stone, green slates, and central tower	7½d	£9 12s 9d per sitting
26	New Barnet, 300 sittings Bk walls, stone dressings no columns	4¾d	£3 17s 4d per sitting
27	Poole Road Bournemouth West, 570 sittings Bk walls stone tracery, turret, tiled roof	5d	£6 18s 8d per sitting
28	Rye Hill Newcastle 1 150 sittings Stone walls internal construction chiefly wood and iron	3½d	£2 10s 6d per sitting
29	Urmston Manchester 350 sittings Stone walls stone turret and spire, no columns	5d	£4 14s 4d per sitting
30	Westgate Road Newcastle 850 sittings Stone walls piers arches tracery pulpit turret and spirelet green slates	5¼d	£6 3s 4d per sitting
31	Salvation Army Hall Lisburn near Belfast (1903) Corr iron on brick plinth timber framework sheeted interior platform lavatory, no fittings	2d	—

Churches

No	Building	Per Ft Cube	Per Unit
32	Macroy Presbyterian Church, Belfast (1894—5) 950 sittings Bk walls stone dressings slated roof, pitch pine woodwork, circular seats gallery, heating pipes, gas lighting Total, £4 300	5¼d.	£4 10s 6d per sitting
33	Presbyterian Church Liscard Cheshire (1902) 450 sittings Ruabon brick stone dressings, electric light Total £3 730	—	£8 5s 10d per sitting
34	St James' Church, Muswell Hill, London (1901), 950 sittings Total, £13 000	—	£13 13s 8d per sitting
35	St John's Church, Ballyclare co Antrim (1902—3), 180 sittings Bk walls stone dressings, slated roof pitch pine woodwork Total £1 050	5¼d	£5 5s 7d per sitting

COAL YARDS

No	1	2	[illegible] Units	Per Unit
36	Coal yard and store Colchester (1901) 150 tons. Bk walls conc floor iron roof £370		3d	£2 11s 6d per ton
37	Coal yard and store Curragh (1901) 100 tons Bk. walls conc floor iron roof £360		4d	£3 12s 6d per ton

CONVENIENCES UNDERGROUND

38	Three underground conveniences Shoreditch costing on an average £3 000 each Conc tiled floor stone steps pavement lighted roof with steel joists w c s urinals and lavatory fittings		3s	£65 per compartment

COTTAGES.

39	C [illegible] 600 sq yds garden and a [illegible] At Bournville 8 % gross return yields 4 % net in this case £7 rent per house 2 stories bk walls tiled and slated roofs wooden floors living room scullery with cabinet bath larder coals w c yard 2 bedrooms and linen closet upstairs		5½d	£175 per dwelling
40	D[illegible] Similar materials		5½d	£395 per dwelling
41	[illegible]		4½d	£251 per dwelling
42	Cottages at Garden City Letchworth Herts (1905) 8 cottages in two blocks 2 stories Each dwelling has living room back room (containing copper sink and bath) pantry coals w c and 3 bedrooms upstairs Bk walls roughcast above tiled roofs Total £1 525 or £191 each		5½d	£191 per dwelling
43	Cottages at Leicester (1905) 2 stories semi-detached Bk walls glazed brick dado to scullery sitting room kitchen larder w c coals and 3 bedrooms on upper floor £458 per pair or £229 each including paving fencing and all fittings		4½d	£229 per dwelling
44	Cottages at Newcastle-on Tyne (1904) 2 stories semi-detached Bk. walls upper part roughcast slated roof hall sitting room kitchen scullery, bathroom and 4 bedrooms and w c on upper floor £840 per pair or £420 each		5d	£420 per dwelling

No	Building	Per Ft Cube	Per Unit
45	Cottages for farm labourers Fareham	5½d	£53 per room
46		4½d	£48 ,,
	or £190 each		
47	Cottages at Leek Staffordshire (1901) 2 terraces of 48 cottages 2 stories, 5 rooms each Bk walls, tiled roofs, tiled kitchen floor bath bay windows of wood and plaster £198 per cottage, plus £10 for roads and drains	3¾d	£40 ,,
48	Co[illegible]	4¾d	£66
49	Municipal cottages Richmond Surrey (1894 and 1900) In blocks of 3, 4 6 and 8 cottages 2 to 6 rooms each 2 stories Bk walls tiled roofs Average of 132 cottages £250 each plus £16 for roads and drains Labour 42 % bricklayer 34 % (*Note* —In reckoning cost per room only living rooms and bedrooms are counted accessories such as sculleries, larders, w c 's coals &c being ignored)	5¾d	£50 ,,

DRILL SHEDS

50	Drill shed, Colchester (1901) Closed Bk walls, slated roof Total £1 550	4d	—
51	Drill shed, Dover Prison (1903) Open type 90 ft × 80 ft Bk walls slated roof Total £620	3d	—
52	Drill shed, Lichfield (1902) Closed Bk walls, slated roof Total £1 500	4d	—

EXHIBITION BUILDINGS

53 Edinburgh Exhibition (1908) All temporary buildings of steel framing, wood, asbestos and fibro plaster —

	£		d		s d	
Art Galleries (28 928 f s)	5 075	total	2½	per f c	3 6	per f s
Canadian Government Pavilion (3,000 f s)	700	,,	2⅛	,,	3 11	,,
Concert Hall, 2 000 persons (16 384 f s)	4 997	,,	2½	,,	6 1	,,
Industrial Hall (2½ acres = 108 900 f s)	10 340	,,	¾	,,	1 10½	,,
Machinery Hall (31 403 f s)	3 246	,,	1	,,	2 0¾	,,
Van Houten Pavilion (2,756 f s) ..	859	,,	4½	,,	6 2¾	,,

No		Price	
54	Glasgow Exhibition (1901). All temporary buildings, of steel wood and fibre plaster —		
		d	*s d*
	Grand Avenue	½ per f c	2 5½ per f s
	Industrial Hall	1¼ ,,	5 4 ,,
	Machinery Hall	½ ,,	1 9¼ ,,
	Concert Hall	2¼ ,,	—
	Restaurants	2 ,,	—
	Fives Courts		
55	Fives court Curragh (1899) 25 ft × 14 ft Bk walls rendered in cement conc floor	4s 8*d* per f s.	£128 each
56	Fives court Limerick (1901) Ditto ditto	4s 1*d* ,,	£93 ,,
	Flats	Per Ft Cube	Per Ft
57	Flats South Audley Street London Stone and terra cotta fire resisting floors hard wood finishings enriched plasterwork &c	1s 2*d*	—
	Gymnasia		
58	Gymnasium Caterham (1901) Bk walls wood block floor slated roof Total £2 900	6*d*	—
59	Gymnasium Dover (1903) 90ft × 30ft Bk walls wood block floor iron and slated roof Total £1 000	5*d*	—
	Hospitals		
6[illegible]	[illegible]	9*d*	£405 per bed
	[illegible] and foundations. Complete cost—land buildings fees furnishing legal and incidental expenses was £210 000 or	—	£607 ,,
61	Curragh Military Station Hospital (1890-94) 80 beds Group of 15 buildings 1 storied connected by closed corridors with reading and dining rooms &c, Bk walls slated roofs Total including accessories, about £25 000		
	Administrative block £6 000	8¼*d*	£74 ,,
	8 ward pavilions £10 000 or £1 250 each	7¼*d*	£125 ,,
	Wardmaster's and steward's qrs, £1 300	9¼*d*	£650 per qtr
	4 nursing sisters qrs £1 100	6½*d*	£275 ,,
	Average including all buildings	8*d*	£312 per bed

Building	Per Ft Cube	Per Unit.
62 Heathcote Infectious Hospital Leamington, 20 beds	—	£395 per bed
63 Herbert Hospital Woolwich military,	—	£320 ,,
	9½d	£216 ,,
buildings only £1 400		
Site formation roads drainage, water mains and external lighting cost £1 900 in addition or	—	£100 ,,
Complete cost per patient £216+£106, or	—	£352 ,,
65 Isolation Hospital Tanfield (1902) 32 beds Administrative block male and female wards on either side and connecting corridors Stone walls, terrazzo floors Total £8 000	—	£250 ,,
66 Isolation Hospital Worksop (1902) 16 beds 4 blocks administrative two wards and laundry Bk walls tiled roof Total £4 745	—	£297 ,,
67 Netley Hospital military including administrative buildings 1 054 beds Bk walls stone dressings wooden floors, slated roof	—	£305 ,,
68 St Thomas' Hospital London (1870) Over 600 beds 8 blocks 4 stories connected by open arcades Bk walls with stone dressings Total £100,000 including administrative buildings	9d	£650 ,,
Ditto one pavilion without administrative buildings	—	£250 ,,

HOTELS

Building	Per Ft Cube	Per Unit.
69 Burlington Hotel Bangor, Co Down (1901) 4 stories and attic Bk walls cemented outside good interior fittings Total, £6 000	6d	—
70 Holborn Viaduct Hotel, London Bk walls stone facings, elaborate interior restaurant	1s 4d	—
71	10½d	—
	1s 6d	—
walls ashlar facing		

Houses

No	Building	Per Ft Cube	Per Unit
73	Dwelling house Chelsea (1902) Stock brick walls green slated roof stables beneath	11*d*	—
74	Dwelling house Orpington Kent (1900 f) 3 stories rooms averaging 15 ft × 12 ft Bk walls tiled roof Total £1 900	1*s*	—
75	Engineer's residence Tower Bridge London (1909) Basement and 3 upper floors Red brick and Portland stone Total £2 685	9¾*d*	—
76	Farmhouse and Dairy Embridge (1909) 2 stories bk walls tiled roof wrot iron casements	6¼*d*	—
77	House Limpsfield Surrey (1907) 3 stories about 25 rooms including billiard room Bk walls roughcasted tiled roofs wood block and tile floors wrot iron casements panelled dadoes	7¼*d*	—
78	House Rothley Garden Suburb Leicester (1908) 2 stories local bk walls tiled roof	5¼*d*	—
79	Terrace house Cliftonville Road Belfast (1896) Bk walls superior facings slated roof Total £930	4¾*d*	—
80	Terrace houses in various parts of Belfast (1898–1903) 2 reception and 4 bed rooms each £250 to £400 per house and letting at £25 to £40 and taxes Bk walls no stonework slated roofs	4½*d*	—
81	Villas in various parts of Belfast (1900–3) 2 reception and 5 bedrooms each £500 to £750 per house and letting at £40 to £55 and taxes Bk walls no stone work slated roofs	4¾*d*	—
82	Ditto 3 reception and 6 bedrooms £750 to £1 000 per house and letting at £55 to £75 and taxes	5¼*d*	—
83	Villas at Helen's Bay Bangor Co Down (1902 3) 3 or 4 reception and 6 bed rooms each over £1 000 per house and letting at £100 to £150 and taxes Brick and stone treatment slated roofs	6¼*d*	—
84	Villa for Medical Officer and Public Dispensary Ballynure Co Antrim (1897) Bk walls superior facings slated roofs Total £750 including drainage and well	4*d*	—
85	Ditto at Crumlin Co Antrim (1902) Same description Total £840 ditto	5¾*d*	—
86	Wesleyan Manse Curragh Co Kildare (1903) 2 stories 10 rooms. Bk walls cement rendered outside porch out buildings and yard Total £1 160	9¼*d*	—

Huts.

No	Building	Per Ft Cube	Per Unit
87	Men's Huts, Dover (1890) 1 story Bk walls, wooden floors, timber and slated roofs	$7\frac{1}{4}d$	—
88	Men's Huts, Pembroke Dock (1887) Ditto 16 men sleeping Total, £280 each	$4\frac{1}{4}d$	£18 per man
	Infirmaries		
89	Axbridge Infirmary for Workhouse, Somerset (1902) 60 beds Total, £5,720	—	£95 per bed
90	Cannock Infirmary for Board of Guardians, Staffs (1901) 48 beds	—	£96 ,,
91	Willesden Infirmary for Parish Workhouse (1903) 400 beds Administrative block, ward blocks, laundry engine house, stables mortuary porter's lodge Bk walls slated roofs, fire resisting floors hot water heating electric light Total, £98 280	—	£246 ,,
	Laundries		
92	Laundry, Londonderry (1909) 1 story, with wash house 14 troughs ironing room and drying closet Bk walls, slated roof tank &c Total, £720	$11\frac{1}{4}d$	£51 per trough.
93	Laundry, Pembroke Dock (1894) 15 troughs Ditto ditto Total, £610	$9\frac{1}{4}d$	£41 ,,
	Law Courts		
9[illegible]	[illegible]	1s 1d	—
9[illegible]	[illegible] £10,000 in addition	$9\frac{1}{4}d$	
	Libraries		
96	Greenwich Public Library (1905) Total £6 000	7d	—
	Municipal Lodging Houses		
97	Darwen Municipal Lodging House (1898) Cubicles for 110 men and 20 women, charge per night, 5d Total, building and furnishing, £7,920	—	£61 per bed.
98	Glasgow Municipal Lodging Houses (seven) (1871—9) Cubicles for 2,166 men and 218 women, charge per night, $3\frac{1}{2}d$ and $4\frac{1}{2}d$ Total, buildings and furnishing, £107,000	—	£44 ,,
99	London Municipal Lodging House, Parker Street, Drury Lane (1893) 324 beds, charge per night, 6d Total, building and furnishing, £22 135	—	£68 ,,

No	Building	Per Ft. Cube	Per Unit
100	Manchester Municipal Lodging House [illegible]	—	£71 per bed
101	[illegible] street (18[illegible]) [illegible] beds charge per night 6d 2 *main blocks 4 stories* Hall day room dining room kitchen baths lavatories dormitories with cubicles Total building and furnishing £16 880	—	£59
	MUSEUMS		
102	British Museum London (1823—47) Stone walls Classic style colonnades main front 370 ft long Total about £1 500 000	1s 6d	—
	OFFICES CITY		
103	City Offices Gracechurch Street London Stone front stone staircase fire resisting floors faience passages lift	1s 1d	—
104	Colonial Chambers Fenchurch Street London	10d	—
	POLICE COURTS		
105	Bow Street Police Station London (1879—81) 4 stories stone Total £40 000	11d	—
	POST OFFICES		
106	General Post Office North (new buildings) St Martin s le Grand London (1890—5) 4 stories stone facings glazed brick courtyard concrete floors asphalted flat roofs Total £170 000	8½d	—
107	Additions to G P O (1905)	9d	—
	PRISONS		
108	Aldershot Military Prison (1900) 72 cells Bk walls conc floors slated roof Total £8 480	11½d	£118 per cell
109	Curragh Military Prison (1893—4) 52 cells Bk walls conc floors slated roof Total £1 180	8d	£155 ,,
	Administrative block (1905) stone	1s	£23 ,,
	Total for all buildings	—	£178 ,,
110	Pentonville Prison London N (1840—2) Bk walls stone dressings conc floors	—	£162 per cell.
	PUBLIC BUILDINGS		
111	Birmingham Exchange and Offices	6d	—
112	*Foreign Offices London* (1861—70) Classic style stone front	*1s 1d*	—
113	Houses of Parliament Westminster [illegible]	2s 6d	—

No	Building	Per Ft Cube	Per Unit
	11 courts Victoria Tower 75 ft square and 336 ft high Clock Tower, 44 ft square and 316 ft high Total about £3,000,000		
114	Local Government Board Offices, Whitehall, London (1904—7) Stone front, Classic style Total £473,000	1s 3d	—
115	New War Office, London Stone walls, Classic style	1s 6½d.	—
116	Railway Clearing House, Seymour Street, Euston Square, London	6¼d	—
117	Royal Exchange, London (1841—4) Total, £180 000	11d	—
	REINFORCED CONCRETE BUILDINGS.		
	COIGNET SYSTEM.		
118	Money Order Office, G P O, Holloway (1910) 5 stories and basement, walls 5 in. thick, Portland cemented externally		
	Reinforced concrete shell only	3½d.	
	Entire building, except heating, lighting, and engineering	8d	—
	COTTANCIN SYSTEM		
119	St Sidwell's Wesleyan Church Exeter (1904) Hollow concrete walls of two 3 in thicknesses and dome	6¼d	—
	HENNEBIQUE SYSTEM.		
120	New General Post Office King Edward Street, London (1906—10) 6 and 7 stories 446 ft × 210 ft, 9 000 000 ft cube Floor area, 10¾ acres, or 467,000 ft sup Total, £295,000		
	Reinforced concrete shell only	2½d	
	Entire building as completed	8d	—
	KAHN SYSTEM		
121	Y M C A Building Manchester (1909—10) 7 floors Large hall, to seat 900 persons, 50 ft span without columns, gymnasium classrooms, café, kitchen, &c Concrete swimming baths, 60 ft × 21 ft, on top floor Reinforced concrete flagstaff, 10 in diameter and 27 ft high Concrete, 1 cement, 2 sand, 4 stone, ¾ in. mesh, and for bath 1 cement, 1½ sand, 2¾ stone, ½ in mesh Total, as completed, £35,000		
	Reinforced concrete shell (walls, floors, filling)	3d.	
	Terra-cotta facing to walls, and fixing	1½d	
	All other trades together, including excavation	5¼d	
	Entire building as completed ..	9¾d	—

No

122. Actual cost of reinforced concrete buildings on the Kahn system erected 1904 9 including 10 per cent profit to contractor

Buildings	Total £	Per Ft. Cub. d	Per Ft Sup s	d
(1) Cold Storage Building	40 010	6	5	0
(2) Factory	2 555	5¾	7	0
(3) Factory	7 960	6½	6	6
(4) Fire Station	1 352	7½	9	0
(5) Garage	2 073	4¼	5	0
(6) Offices and Stores	36 230	6¾	8	0
(7) Store House	28 351	4½	4	6
Highest	—	7½	9	0
Lowest		4¼	4	6
Average	—	5¾	6	9

Cost of Parts

Average of 9 constructions erected 1904 9

Position	Reinforced Concrete Per Ft. Cub. s	d	Centering Per Yd Sup s	d
(1) Bearers and girders	1	5	4	6
(2) Columns	1	2½	4	0
(3) Footings and mass concrete	0	10	1	6
(4) Slabs between steel beams	1	1¼	1	9
(5) Slabs flat	1	3	2	6
(6) Walls above ground level	1	2½	3	6
(7) Walls below ground level	1	0	2	6
Highest	1	5	4	6
Lowest	0	10	1	6
Average	1	1¼	3	0

Steel Reinforcement

Average cost of fabricating and handling the steel in 21 constructions using the loose method was £2 10s 6d per ton

Ditto in 28 constructions using the unit method was 15s 6d per ton

Add these rates to cost of steel delivered on job

Riding Schools

No	Building	Per Ft. Cube	Per Unit
123	Riding School Lisburn Road Belfast (1898) Size 150 ft × 30 ft × 16 ft to eaves Bk walls open sheeted roof with iron trusses cinder floor covered with peat litter	3d	
124	Riding School Newbridge (1907) 150 ft × 53 ft Bk walls steel and slated roof 12 in tan and sawdust floor Total £4 000	3½d	—
125	Riding School York (1902) Ditto Total £3 700	3½d	—

No	Building	Per Ft Cube	Per Unit
	11 courts Victoria Tower 75 ft square and 336 ft high Clock Tower 44 ft square and 316 ft high Total about £3 000 000		
1		1s 3d	—
1		1s 6½d	—
116	Railway Clearing House Seymour Street Euston Square London	6½d	—
117	Royal Exchange London (1841—4) Total £180 000	11d	—
	REINFORCED CONCRETE BUILDINGS		
	COIGNET SYSTEM		
118	Money Order Office G P O Holloway (1910) 5 stories and basement walls 5 in thick Portland cemented externally		
	Reinforced concrete shell only	3½d	
	Entire building except heating lighting and engineering	8d.	—
	COTTANCIN SYSTEM		
119	St Sidwell's Wesleyan Church Exeter (1904) Hollow concrete walls of two 3-in thicknesses and dome	6½d	—
	HENNEBIQUE SYSTEM		
120	New General Post Office King Edward Street London (1906 10) 6 and 7 stories 446 ft × 210 ft 9 000 000 ft cube Floor area 10¾ acres or 467 000 ft sup Total £295 000		
	Reinforced concrete shell only	2½d	
	Entire building as completed	8d	—
	KAHN SYSTEM		
121	Y M C A Building Manchester (1909—10) 7 floors Large hall to seat 900 persons 50 ft span without columns gymnasium classrooms café kitchen &c Concrete swimming baths 60 ft × 21 ft on top floor Reinforced concrete flagstaff 10 in diameter and 27 ft high Concrete 1 cement 2 sand 4 stone ¾ in mesh and for bath 1 cement 1½ sand 2¾ stone ¾ in mesh Total as completed £35 000		
	Reinforced concrete shell (walls floors filling)	3d	
	Terra cotta facing to walls and fixing	1½d	
	All other trades together including excavation	5⅛d	
	Entire building as completed	9⅝d	—

No.
122. Actual cost of reinforced concrete buildings on the Kahn system erected 1904–9 including 10 per cent profit to contractor

Buildings	Total £	Per Ft. Cube d.	Per Square
(1) Cold Storage Building	40 010	[illegible]	[illegible]
(2) Factory	2 755	[illegible]	[illegible]
(3) Factory	7 960	[illegible]	[illegible]
(4) Fire Station	1 372	[illegible]	[illegible]
(5) Garage	2 078	[illegible]	[illegible]
(6) Offices and Stores	36 230	[illegible]	[illegible]
(7) Store House	29 371	[illegible]	[illegible]
Highest		[illegible]	[illegible]
Lowest	—	[illegible]	[illegible]
Average		[illegible]	[illegible]

Cost of Parts

Average of 9 constructions erected 1904–9

Position	Per Ft. Cube s. d.	Per Square
(1) Bearers and girders	[illegible]	[illegible]
(2) Columns	[illegible]	[illegible]
(3) Footings and mass concrete	[illegible]	[illegible]
(4) Slabs between steel beams	[illegible]	[illegible]
(5) Slabs flat	[illegible]	[illegible]
(6) Walls above ground level	[illegible]	[illegible]
(7) Walls below ground level	[illegible]	[illegible]
Highest	[illegible]	[illegible]
Lowest	[illegible]	[illegible]
Average	[illegible]	[illegible]

Steel Reinforcement

Average cost of fabricating and handling the steel in 21 constructions using the loose method was £2 10s 6d per ton.

Ditto in 28 constructions using the unit method was 15s 6d per ton.

Add these rates to cost of steel delivered on job.

Riding Schools

No.	Building	Per Ft. Cube	Per Foot Super
123	Riding School, Lisburn Road, Belfast (1898). Size 150 ft × 30 ft × 18 ft to eaves. Bk walls, open sheeted roof with iron trusses, cinder floor covered with peat litter	3d	
124	Riding School, Newbridge (1902). 150 ft × 53 ft. Bk walls, steel and slated roof, 12 in. tan and sawdust floor. Total £1 000	3¼d	
125	Riding School, York (1902). Ditto. Total £3 700	3¼d	

Schools

No.	Building	Per Ft Cube	Per Unit
126	Ballymacarrett Mixed School Belfast under the National Board (1898) 2 stories bk walls open tiled roof sheeted inside	4¾*d*	—
127	Drogheda Board School (1898) 1 story and small basement Rubble walls cemented externally brick and wooden partitions porches	4*d*	—
128	Fletton Board School Hunts (1900) 240 infants and 360 mixed pupils 600 total Central hall system Fletton brick walls Ketton stone dressings Total £6 000	—	£10 per scholar
129	Halifax —Battinson Road Board School (1901) 1 000 scholars Buildings only £14 720	3¾*d*	£15
	Ditto with mechanical ventilation	4⅝*d*	£18
	Ditto including cost of site buildings heating ventilating furnishing and architect s commission £31 550	8*d*	£32
130	Hornsey Schools London Bk walls wood block floors &c	7½*d*	—
131	Liver[illegible] £35 000	—	£21 per scholar
132	[illegible] and furniture of £176 530 Detail		

	£ s d
Site including legal and surveyor s charges	0 13 3
School buildings only brick 3 or 4 stories and superintendence about	14 0 0
Adjuncts such as drainage play grounds boundary walls school keeper s house cookery laundry manual training special school or other centres and superintendence	13 1 0
Furniture and fittings charged to capital account	0 15 9
Total	37 10 0

Allow 10 per cent for cost of furniture and expenses of architect s department

No.	Building	Per Ft Cube	Per Unit
133	London School Board Forest Hill School (1901) 908 scholars School buildings only	—	£16

No.	Building	Per Ft Cube	Per Unit
	Total of builder's work including a manual centre £21 ^90	—	£21 per [illegible]
134	Seaton Sluice School Northumberland (1910—11) 300 scholars Pavilion type without central hall one story Cheap construction timber framed building with 1 in Frain slab casing ferro concrete foundations wood block and cone floors cement dadoes asbestos slates on roof boarding Buildings only	5½d	£[illegible]
	Out offices and boundary walling asphalted playground and drainage cost £525		£1 1[illegible]s 0d
	Total including buildings and accessories		£8 11s 6d
135	Walthamstow Methodist Sunday School London (1901) 1 100 children Gallery staircases open timbered roof incandescent gas lighting Also caretaker's apartments school kitchen offices heating chamber &c Total £3 500		
	Cost for assembly hall only	—	£3 3s 0d
	Cost for class rooms only		£1 7s 6d
136	Wishaw Board School (1902) 644 scholars Central hall classrooms Total £6 000	—	£9

TENEMENTS

No.	Building	Per Ft Cube	Per Unit
137	[illegible] 1898 Stone walls	5d	—
138			
		4½d	£70 per room
		5½d	—
	stone	5¼d	£71 per room
	Saltmarket Tenements (1890) brick	5¼d	£92
	St James Road Tenements No 2 (1897) stone	6d	£93
	St James Road Tenements No 3 (1900) stone	4¾d	£70
139	Liverpool — Dryden Street Tenement [illegible]	8½d	£67
	walls unplastered rooms balcony back of first floor		

No.	Building.	Per Ft Cube	Per Unit
	Type B —Contains two 2 room tenements on ground and upper floors and rest as foregoing	7d	£59 per room
140	[illegible] s	7d	£63 ,,
141	[illegible] the London County Council Works Dept Usually 4 main stories with roof story but also 2 story cottage tenements 2 room 3 room suites &c each having w c and scullery Living rooms seldom exceed 144 ft sup or 8 ft 6 in high Bk walls fire resisting construction conc floors slated or tiled roofs staircases lined with glazed bricks sculleries rendered in cement —		
	First class tenements	9½d	—
	Second	9d	—
	Third	8¼d	—
142	London —Boundary Street Block Dwellings Bethnal Green (1893—7) Largest scheme under the Housing Acts 15 acres of slums being cleared 23 separate blocks divided into 5 classes of buildings mostly with 2 and 3 rooms sculleries &c Bk walls stone dressings Total for buildings £280 000	9d	£107 per room
143	London —Cottage flat Dwellings Lisson Grove 4 stories each tenement having separate entrance and staircase [illegible]	6½d	£60 ,,
1[illegible]	[illegible] gymnasium shed Fitted for electric light Rents from 3s per room Total £17 780	10¾d	£107 ,
145	London —Hayles Trust Tenements St George's Road Southwark (1898) Common staircase with two 3 room tenements to each landing Let at 7s per week	8¼d	£70
146	London —Millbank Tenements (1899—1902 For 4 430 persons 5 stories mostly with 2 and 3 room tenements with independent scullery and conveniences (17 blocks in all were erected Land £22 212 approaches roads, and open spaces £22 960, buildings £206 959 total £252 161 Site cost £2 500 per acre)	8d	£87 ,

No.	Building	Per Ft Cube	Per Unit.
147	London —Totterdown Fields Estate, Tooting (1903 8) Artisans' cottages brick Cost, including professional and incidental expenses —		
	£ £		
	5 roomed cottages 349 to 381 each	Average	
	4 " " 235 , 273 "	6½d	—
	3 " " 192 , 216 "		
148	London —Waterlow s Industrial Dwellings	7¼d	—
149	London —White Hart Lane Estate, Tottenham (1903—8) Artisans cottages brick Cost including professional and incidental expenses —		
	5 roomed cottages £254 each	Average	
	4 " " £204 "	5d	—
	3 " " £169 "		
150	London — Demolitions and clearing slums in central districts for new tenements	—	15s to 17s per f s
	Ditto, per head of new occupation	—	£38 per head
	When cleared the land is worth	—	10s per f s
151	London —Actual cost of sites for rehousing have ranged from	—	£3 to £22 per y s
	But have mostly fluctuated between	—	£3 to £6 "
	Averaging £125 per room erected		
	The cost of these sites, however, is "written down ' to a "housing valuation" varying from	—	10s to £3 "
	Or £10 to £25 per room erected		
	The avarage site area per room erected was 25 y s		
	Few schemes pay if the charge for land alone is more than 5s per ft sup , or	—	£2 5s "
	THEATRES		
152	Brixton Theatre London, 2,000 seats Bk walls, stone dressings electric light	—	£15 per seat
153	Glasgow Empire Theatre Stone and bk walls	—	£13 "
154.	York Grand Opera House (1901), 1,500 seats Total, £24,000	—	£16 "
	TOWN HALLS		
155	Deptford Town Hall Stone and bk walls	1s 2d	—
156	Enniskillen Town Hall, Co Fermanagh (1897) 2 stories, with basement and attic Walls, ashlar facing, with bk. backing balustrade, 6 story tower, lead-covered dome, hot air heating, &c Total, £11,000	7d	—
157	Glasgow Municipal Buildings (1883—8). Classic style, main front 246 ft , stone	1s. 5d	—

No	Building	Per Ft Cube	Per Unit.
	walls, tower Architect's estimate per ft cube was—basement, 9*d*, superstructure, 1*s*, towers, 1*s* 6*d*		
158	Holborn Town Hall and District Board Offices (1879), frontages 124 ft and 100 ft Public hall for 1,200 persons, clock tower 100 ft high Walls of brick and stone Total, £26,000	1*s* 2*d*	—
159	Lambeth Town Hall London Brick and stone	1*s* 1*d*	—
160	[illegible]	1*s* 2*d*	—
161	[illegible]	11½*d*	—

WAREHOUSES

No	Building	Per Ft Cube	Per Unit.
162	Warehouses, Drapery London Stone front, fire resisting floors	1*s* 1*d*	—
163	Warehouses Thames Street London Bk walls unplastered wood floors	7*d*	—
164	W[illegible]	5½*d*	—

WORKHOUSES

No	Building	Per Ft Cube	Per Unit.
165	Greenwich Workhouse, (1900) 816 inmates 20 blocks covered ways, chapel, laundry, bakery, &c Total, £175,000	—	£215 per inmate
166	Hastings Workhouse (1902) 338 sleeping inmates 8 main blocks casual ward 44 compartments, workshops bakery, laundry, boiler house chimney shaft 60 ft, porter's offices, &c Bk walls, stone dressings Total £55 000	—	£163 ,,
167	Isleworth Workhouse Middlesex (1901) 800 inmates Administrative block, chapel, porter's lodge old married couples' quarters, stabling engine room, electric light Bk walls, stone dressings, slated roofs, fire resisting staircases Buildings, £82 630 Total with furnishing, £100 000	—	£125 ,,
168	Southmead Workhouse Westbury on Trym (1902) 110 inmates and 24 casuals 5 main blocks, with offices, tr[illegible]mp wards, md qrs, workshops, hot [illegible]r heating, infirmary for 2[illegible] [illegible], with bounda[illegible] and [illegible]ous hospital [illegible]nts [illegible]ngs, furnish[illegible] [illegible] cost £20 000, [illegible] £37[illegible]0	—	£216 ,,

No	Building	Per Ft Cube	Per Unit
169	Stamford Workhouse (1902) 175 inmates 5 groups of buildings bk and stone walls glazed dadoes slated roofs electric lighting Total £30 000	—	£170 per inmate
170	Wolverhampton Workhouse (1902) 1 230 inmates including infirmary and imbecile wards Bk walls, slated roofs	—	£146 ,,

Relationship of Trades —⅔ cost of a building are for carcass, remaining ⅓ is for finishings Brickwork is about ⅓ total value, carpenter and joiner nearly the same.

Only a rough idea can be given of the percentage cost of each trade to the total cost of building work, as it differs with materials and design, but for ordinary brick dwellings take as below —

Trade	Proportional Cost to Total Work
Excavator	3 per cent
Concretor	4 ,,
Drainlayer	2 ,,
Bricklayer	33 ,,
Mason	1 ,,
Slater or Tiler	5 ,,
Carpenter and Joiner	30 ,,
Smith and Founder	5 ,,
Plumber and Zincworker	6 ,,
Plasterer	6 ,,
Painter	3 ,,
Glazier and Paperhanger	2 ,,
	100

The speculating builder sublets a good many trades and

A building of two or more stories is cheaper in proportion than a structure of only one story, as so much excavation, foundations, and roofing are saved.

Work done in small quantities is worth more than large—20 to 25 per cent more.

Method of Erection—This also affects completed cost

(*a*) The cheapest and best method is a contract on quantities

(*b*) Next, a contract on drawings and specification only, without quantities, 5 per cent more

(*c*) Then measured work on a schedule of prices, 10 per cent more

(*d*) And, least advisable, direct labour supervised by the building owner s clerk of works, 25 per cent more This is because the employer has none of the large plant and facilities which a contractor possesses, and because he is unable to obtain materials at trade discounts and wholesale prices, and lacks experience generally

Schedules of Prices—For Government works, such as barracks and forts, where the amount executed may be uncertain or small a schedule of prices is made the basis of contract, the job being measured on completion One of the best is the War Department Schedule of Prices, revised triennially and those of the Office of Works and London School Board are likewise good

In France a similar publication is the ' Série des Prix," which forms the basis of tenders for municipal works in Paris, and which is thoroughly arranged and treated

Notebook of Costs—Architects and builders are advised, for their own sakes, to keep a notebook, setting forth the buildings put up by them, and giving such particulars as date of erection estimated cost, highest tender, lowest tender and actual cost as finished An office record of this sort is simply invaluable

Maintenance and Repairs—Allow 1 per cent per annum of capital cost of buildings for upkeep and repair—equivalent to about 15 per cent of gross rent, or 20 per cent of net rent

House Property—The rent of a man s house is supposed to be $\frac{1}{10}$th of his income but in big cities it is often as high as $\frac{1}{8}$th, or even $\frac{1}{4}$th

The net rent of a first class town dwelling may be calculated at 5 per cent of its net cost in building or of its present value, exclusive of ground rent To obtain the net rent take off the following ' outgoings or " deductions from the gross rent, the higher percentages being for small tenements, which are more troublesome and risky Rates and taxes must also be considered, whether payable by landlord or tenant

Deduct from gross rental—

	Per cent
For repairs or renewals	10 to 20
For collection of rents and management	2½ to 5
For casualties, risk through loss of tenants or rent	2½ to 12½
For insurance	2s to 5s.

To capitalise the value of the property —Net rent × 100 ÷ rate per cent required = price Or, to put it another way, 100 ÷ 5 per cent interest required = 20 years' purchase of net rental

Example.	£	s	d	£	s	d
[illegible] ...al of ... pay [illegible]				100	0	0
[illegible]	14	18	0			
[illegible]	10	0	0			
Collection and management at 2½ per cent	2	10	0			
Casualties and loss at 2½ per cent	2	10	0			
Insurance at 2s per cent = $\frac{1}{10}$ per cent.	0	2	0			
				30	0	0
Net annual income or net rental				70	0	0
To pay 5 per cent = 20 years purchase multiply by						20
Gross value				1 400	0	0
Allow for capital outlay upon immediate repairs or alterations				50	0	0
Capitalised value				£1 450	0	0

Summary of Relative Costs

1 London building prices are 5 to 15% more than provincial rates

2 Prime Cost or P C is the net trade price of an article after deducting trade discount from catalogue list price

3 List Price, or L P, is the published catalogue price

4 Discount two kinds Trade discount, 2½ to 50% off catalogue price And Cash discount for quick payment for goods—prompt cash 5% off and payment within one month 2½% off

5 Establishment charges 5% Interest on capital and 5% per ann [illegible] arge jobs, 15% on sr[illegible] uted, and 50% of m[illegible]

8 Canal transport, ⅓ to ½ cheaper than railway, about ½d. per ton mile, plus 1½d to 3d per ton for canal wharfage

9 Railway carriage, roughly 1d per ton mile, but quicker than canal, on continent, ½d per ton mile

10. For packing and carriage of stores in the United Kingdom allow 15 /ₒ of their cost

walls, drainage

te for ordinary

13. Professional charges on cost of building—architect 5 /ₒ, quantity surveyor 1½ /ₒ, clerk of works 1½ /ₒ. Legal, site, furnishing, &c, uncertain

14. Stone buildings cost 10 to 20 /ₒ more than brick ones, iron and wooden buildings 30 to 50 /ₒ less. Reinforced concrete 20 to 30 /ₒ general economy

15. ⅔ cost of a building are for carcass, remaining ⅓ is for finishings

16. Brickwork is about ⅓ total value, carpenter and joiner nearly the same

17. Work done in small quantities is 20 to 25 /ₒ more expensive than in large, jobbing up to 40 /ₒ increase

18. In comparison with a building erected by contract on quantities—

If on drawings and specification only without quantities .. add 5 /ₒ

19 their capital cost ... 10 to 20 /ₒ of rent

20. Rent of a man's house supposed to be $\frac{1}{10}$ his income, but in big cities often as high as ⅕ or ¼. Net rent 5 /ₒ value of building

CHAPTER III.—LABOUR.

The ratio of labour to material is an important factor in the calculation of the value of builder's work, and good or bad artisans may frequently make the difference between profit and loss on a building. In fact, labour is the leading speculative item in most construction. Idle and indifferent workmen always mean a hurt to their employer, and this has [illegible]

on the strict supervision of the negro. The British mechanic, however, is capable and energetic when he likes to exert himself, but trade unions have lessened the amount of his work and by insisting upon a uniform rate of wages have reduced the good operative to the level of the indifferent one. This, and the risk which contractors run as a result of the various trades disputes, have caused a general advance in rates to meet contingencies. Wages have increased, while the working hours have been reduced. It is said the English tradesman only executes one half of the work he used to do, which means a wanton national loss. This must inevitably react upon the men themselves, for during the great masons' strike of 1877 some hundreds of Germans, as well as Americans and Canadians, were brought over for the London Law Courts, then in progress. Architects avoided masonry, and turned their attention to the possibilities of ornamental brick and terra-cotta. Similarly the plasterers' strike of 1896 caused the mechanical fibrous plastering and matchboarding to largely oust the usual material.

The increased cost of building is also due to the liabilities incurred under the Factory and Workshop Acts, the Employers' Liability Act, 1880, and the Workmen's Compensation Acts, 1897, 1900, and 1906, as well as to the exacting building regulations now in force, and to the greater conveniences and ornamentation in present day houses.

Proportion of Labour to Materials.—For good housework the labour is about 47 per cent., and materials about 53 per cent., of total cost. In building 70 two story municipal

cottages at Richmond during 1894 and 1900, it was found that the cost of labour was 42 per cent of the whole. The following table shows the proportion which labour and materials bear to each other in the different trades —

PROPORTION OF LABOUR TO MATERIALS

Trade	Labour	Materials and Plant.
Excavator	90 per cent	10 per cent
Concretor	17	83
Drainlayer	33	67 ,,
Bricklayer	30	70 ,,
Mason	50	50
Slater	15	85 ,,
Tiler	20	80 ,,
Carpenter	30	70 ,,
Joiner	60	40 ,,
Smith	23	77 ,,
Plumber	25	75
Plasterer	60	40 ,,
Painter	50	50 ,,
Glazier	15	85 ,,
Paperhanger	30	70 ,,
Gasfitter	25	75 ,,

Hours.—Hours and wages alter according to locality and season and it may be added according to strikes, but, generally speaking the time is 9 hours per day in summer and 8 hours in winter with 5 hours on Saturday in summer and 4 hours in winter. This may be taken at 60 hours per week in summer, 47 hours in spring and autumn and 44 hours in mid winter. The trade unions are constantly wanting shorter hours and higher wages. The National Association of Master Builders issue statements from time to time as to the condition of trade, showing the state of the labour market and giving comparative lists of the hours worked per week and the rate of wages in the various branches of the building trade throughout the United Kingdom.

Wages.—The following are the average current rates per hour. Builders should find out local wages as they may materially affect the estimate.

TABLE OF WAGES

Trade	London	Provinces		
	d	*d*		*d*
Excavator	7½	5	to	6½
Ganger	8	6	,,	7
Carter or Driver	6½	5	,,	6
Labourer General	7	5	,,	6½

TABLE OF WAGES—*continued*

Trade	London	Provinces
	d	*d* *d*
Navvy	7½	5 to 6½
Engine Driver	9	7 ,, 8½
Watchman Day or Night	6½	5 ,, 6
Bricklayer	10½	8 ,, 10
Bricklayer's Labourer	7	5 ,, 6½
Scaffolder	7½	5 ,, 7
Mason	10½	7 ,, 9½
Mason, Granite or Marble	11½	8 ,, 10
Mason's Labourer	7	5 ,, 6½
Stone Carver	16	12 ,, 14
Pavior	9½	6½ ,, 8
Pavior's Labourer	7	5 ,, 6
Slater and Slate Mason	9½	8 ,, 9
Slater's Labourer	7	5 ,, 6
Tiler	9½	8 ,, 9
Tiler's Labourer	7	5 ,, 6
Thatcher	9½	7 9
Thatcher's Mate	7	5 ,, 6
Carpenter	10½	8 ,, 9½
Carpenter's Labourer	7	5 ,, 6
Joiner	10½	8 ,, 9½
Woodworking Machinist	10½	8 ,, 9½
Smith	10	8 ,, 9
Smith's Labourer	7	5 ,, 6
Coppersmith	10	8 ,, 9
Coppersmith's Labourer	7	5 ,, 6
Bellhanger	9½	8 ,, 9
Bellhanger's Labourer	7	5 ,, 6
Plumber	11	8 ,, 9½
Plumber's Mate	7	5 ,, 6½
Zincworker	11	8 ,, 10
Zincworker's Labourer	7	5 ,, 6
Plasterer	11	8 ,, 10
Plasterer's Labourer	7	5 ,, 7
Painter	9	7 ,, 8½
Painter's Labourer	6½	5 ,, 6
Grainer or Writer	12	9 ,, 10
French Polisher	9	7 ,, 8½
Gilder	12	9 ,, 10
Glazier	9	7 ,, 8½
Glazier's Labourer	6½	5 ,, 6
Paperhanger	9	7 ,, 8½
Paperhanger's Labourer	6½	5 ,, 6
Gasfitter	9½	8 ,, 9
Gasfitter's Labourer	7	5 ,, 6
Electrical Wireman	9½	8 ,, 9
Electrical Labourer	7	5 ,, 6

Day Work.—For day labour (*i.e.*, payment by the hour) at the current rate of wages, add 15 per cent to cover superintendence, use of tools and plant, and profit

Methods of Payment.—Besides ordinary day work there are other methods of payment, such as task work, piece work, and premium systems.

(*a*) Task work is uneven because the quick man does not labour a full day or the slow man finish his job.

(*b*) Piece work frequently necessitates alteration of the rate per piece, causing dissatisfaction.

(*c*) Premium systems yield fair wages to beginners, rate cutting is reduced, and both employer and employe benefit by rapid output.

The commonest form is the 50 %, by which the artisan is paid for his actual time on a job, plus half the time he saves. A fair period of say 8 hours is allotted. If he completes in 6 hours, thereby saving 2 hours, he is paid for $6 + 1 = 7$ hours. The master thus profits by an hour's wages less than the time allowed and the mechanic by an hour more than actually worked.

Another is the Rowan system, which is—(time worked × hourly rate) $\left(1 + \frac{\text{time saved}}{\text{time allowed}}\right)$. This seems complicated and harder to understand, but the more time saved the more is credited to the workman in proportion. Rate cutting is lessened and the employer does not suffer so much.

London District.—The "London District," within which is the agreement as to wages and hours of labour between the Central Association of Master Builders of London and the various Trades Unions, is a circle of 12 miles radius, measured in a straight line from Charing Cross. This limit has been adopted by the Works Department of the London County Council and increased to 20 miles. For plumbers the term "London District" means six miles radius from Charing Cross.

Overtime.—Overtime in London, when worked at the request of the employers but not otherwise, is paid at the following rates:—From leaving-off time until 8 p.m., time and a quarter; from 8 p.m. to 10 p.m., time and a half; after 10 p.m., double time. On Saturday the pay for overtime from noon to 4 p.m. is time and a half, and after 4 p.m. and Sunday, double time. Christmas Day is paid the same as Sunday.

Night Gangs.—Workmen engaged on a night gang are paid 1d. per hour in addition to the ordinary rate of wages, but the hours worked without overtime rates are not to exceed 9. Meal time hours during the night to be one

and a half From Saturday midnight to Sunday midnight double time

Sent from Shop or Job —Men who are sent from the shop or job, including those engaged in London and sent to the country, are allowed as expenses 6*d* per day for any distance over 6 miles from the shop or job, exclusive of travelling

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engagement

Tide Work —For tide work the work in water or liquid mud is allowed as ordinary time and a third, work interrupted by tides is allowed as ordinary time and a half, and when work is in water and interrupted by tides double ordinary time is allowed The contractor finds water boots without extra charge

Labourers' Attendance —Each mechanic will require a portion or the whole of a labourer s time to attend upon him

The usual allowance,

k, is one labourer to

observed by the trade

societies Painter's work is often performed by a labourer, as well as whitewashing &c, which means a considerable saving Taking down old walling and timbering can likewise be frequently done by labourers

Interference with Trades —This is sometimes serious, and means delay, as the following cases will show —A builder had to do a large amount of plain tiling upon a roof This was formerly done by tilers, who understood their work, but the bricklayers said that was their job and struck The building was thus kept back for many weeks

In another instance a stone template was required to be laid The bricklayer, in proceeding with his work, was not allowed to lay the template but a mason who was on the other side of the building had to be brought round to put it in position, and then went back to his masonry

The Conciliation Boards of the various trades now settle these frequent claims as to demarcation of work

Constants of Labour

Constants of labour are valuable when it is required to ascertain the time it will take a man to execute a particular class of work They are useful in making approximate estimates, and are based on the principle that a man works

Methods of Payment.—Besides ordinary day work there are other methods of payment, such as task work, piece work, and premium systems

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societies Painter s work is often performed by a labourer as well as whitewashing &c which means a considerable saving Taking down old walling and timbering can likewise be frequently done by labourers

Interference with Trades —This is sometimes serious and means delay as the following cases will show —A builder had to do a large amount of plain tiling upon a roof This was formerly done by tilers who understood their work but the bricklayers said that was their job and struck The building was thus kept back for many weeks

In another instance a stone template was required to be laid The bricklayer in proceeding with his work was not allowed to lay the template but a mason who was on the other side of the building had to be brought round to put it in position and then went back to his masonry

The Conciliation Boards of the various trades now settle these frequent claims as to demarcation of work

Constants of Labour

Constants of labour are valuable when it is required to ascertain the time it will take a man to execute a particular class of work They are useful in making approximate estimates and are based on the principle that a man works

Methods of Payment.—Besides ordinary day work there are other methods of payment such as task work, piece work and premium systems.

(*a*) Task work is uneven because the quick man does not labour a full day or the slow man finish his job.

(*b*) Piece work frequently necessitates alteration of the rate per piece causing dissatisfaction.

(*c*) Premium systems yield fair wages to beginners, rate cutting is reduced and both employer and employee benefit by rapid output.

The commonest form is the 50% by which the artisan is paid for his actual time on a job plus half the time he saves. A fair period of say 8 hours is allotted. If he completes in 6 hours, thereby saving 2 hours, he is paid for 6 + 1 = 7 hours. The master thus profits by an hour's wages less than the time allowed and the mechanic by an hour more than actually worked.

Another is the Rowan system which is —(time worked × hourly rate) $\left(1 + \frac{\text{time saved}}{\text{time allowed}}\right)$ This seems complicated and harder to understand but the more time saved the more is credited to the workman in proportion. Rate cutting is lessened and the employer does not suffer so much.

London District.—The London District within which is the agreement as to wages and hours of labour between the Central Association of Master Builders of London and the various Trades Unions is a circle of 12 miles radius measured in a straight line from Charing Cross. This limit has been adopted by the Works Department of the London County Council and increased to 20 miles. For plumbers the term London District means six miles radius from Charing Cross.

Overtime.—Overtime in London when worked at the request of the employers but not otherwise is paid at the following rates.—From leaving-off time until 8 p.m. time and a quarter; from 8 p.m. to 10 p.m. time and a half; after 10 p.m. double time. On Saturday the pay for overtime from noon to 4 p.m. is time and a half, and after 4 p.m. and Sunday double time. Christmas Day is paid the same as Sunday.

Night Gangs.—Workmen engaged on a night gang are paid 1d. per hour in addition to the ordinary rate of wages, but the hours worked without overtime rates are not to exceed 9. Meal time hours during the night to be one

and a half From Saturday midnight to Sunday midnight double time

Sent from Shop or Job —Men who are sent from the shop or job, including those engaged in London and sent to the country, are allowed as expenses 6*d* per day for any distance over 6 miles from the shop or job, exclusive of travelling [illegible] me [illegible] , an engagement

Tide Work —For tide work the work in water or liquid mud is allowed as ordinary time and a third work interrupted by tides is allowed as ordinary time and a half, and when work is in water and interrupted by tides double ordinary time is allowed The contractor finds water-boots without extra charge

Labourers' Attendance —Each mechanic will require a portion or the whole of a labourer s time to attend upon him in supplying material &c , to the spot The usual allowance, taking an average over all the work, is one labourer to one artisan, and this is the rule observed by the trade societies Painter's work is often performed by a labourer, as well as whitewashing &c , which means a considerable saving Taking down old walling and timbering can likewise be frequently done by labourers

Interference with Trades —This is sometimes serious, and means delay, as the following cases will show —A builder had to do a large amount of plain tiling upon a roof This was formerly done by tilers, who understood their work, but the bricklayers said that was their job and struck The building was thus kept back for many weeks

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The Conciliation Boards of the various trades now settle these frequent claims as to demarcation of work

Constants of Labour

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a certain average amount per hour or per day as the case may be. Constants however cannot be relied upon for work as a whole, as they only represent the actual labour expended upon a certain piece of work, and do not cover that wasted in the intervals between for rest and miscellaneous occupation. Those given in Fletcher's "Quantities" and in Hurst's "Architectural Surveyor's Handbook" are for the hour. These latter are simply invaluable, and are the best yet formulated in this country, indicating great thought and long experience. Gauthey in his valuable work "*Traité de la Construction des Ponts*" has also given very many constants from experiments made upon the labours of French workmen.

Constants are simply multipliers, and one has only to multiply the rate per hour or per day by the corresponding constant to find the price of the labour on any item. To this must be added the cost of the material, and the total will give the estimated prime cost of the work, to which would be affixed the 20 per cent. profit and charges.

1. For example, when the constant is given by the hour:—

		Constant
Excavating in stiff clay or gravel, per yard cube		1·5 hours

An excavator gets 7½*d.* per hour, therefore—

7½*d.* × 1·5 = 11¼*d.*	prime cost per yard cube
	cost of material, nil
2¼	add 20 per cent. profit, &c.
13½*d.*	total price per yard cube

2. The same example, when worked out by the constant for the day of 9 hours, would appear:—

		Constant
Excavating in stiff clay or gravel, per yard cube		·167 day

An excavator gets 7½*d.* per hour × 9 hours = 5*s.* 7½*d.* per day, therefore

5*s.* 7½*d.* × ·167 = 11¼*d.*	prime cost per yard cube
	cost of material, nil
2¼	add 20 per cent. profit, &c.
13½*d.*	total price per yard cube

How are the constants arrived at? The following will explain:—If a mason can saw 12·5 super. feet of stone per day of 9 hours (whole sawing), the constant will be obtained if we divide 1 day by the number of feet he has sawn, or 1 ÷ 12·5 = ·080 of a day.

In the same way we can find the constant for any particular work. Take, for instance, the constant for laying 4 in drain pipes, obtained thus —It has been found by careful observation that a bricklayer and labourer can lay 100 feet of 4 in socket pipes in a day of 9 hours, so if we divide 1 day by the length of pipe laid, we get $\frac{1}{100}$ = 010, the constant of labour of a day

The practical estimator seldom makes much use of constants, as he generally refers to former priced bills of quantities, private notes, merchants quotations &c, to enable him to make up his prices. Little use is therefore made of constants by the author in this book as they are often ridiculously minute as regards the number of decimal places though they serve as a mathematical guide in the adaptation of time

The cases given are very simple ones and have been purposely chosen to illustrate the first application of these factors. Perhaps on the whole owing to the smallness of most items it is handiest to use constants dealing with the decimal parts of hours than those treating of the fractions of days especially as the latter vary being longer in summer and shorter in winter. Different authorities give different constants according to how they regard the capabilities of the workmen but those of Hurst and Fletcher may be regarded as fairly accurate

Electricity in Building Operations

Electricity in building operations must soon be generally adopted where works are at all extensive for when these are being constructed within a convenient distance of electricity supply mains the use of steam as a source of power is only a waste of time and money. Contractors should employ up to date methods and great economies are effected by electric driving

The advantages of electricity were well exemplified by the Home Office new buildings erected about 1901-7 at the bottom of Whitehall London and costing about £471 000. No fewer than 25 millions of bricks were required as well as 2 000 tons of steel work and 250 000 ft cube of stone. The contractors were at first reluctant to abandon steam, but after a trial of electricity became quite enthusiastic in its favour. An unusually accurate comparison of working costs was made as on parts of the job similar steam driven and electric driven appliances were doing identically the same work. By the latter a reduction was obtained in the

labour expenses of from £10 to £12 per week, without reckoning quicker progress, superior convenience, freedom from dust, cleanliness, and increased efficiency

Electric power can manipulate many building machines, but chiefly electric cranes and electric mortar mills, of which the following experiences have been gained in the erection of the Home Office, and on edifices in Edinburgh, Glasgow, and elsewhere —

Electric Cranes —In the case of the Home Office the electric energy was conducted into the crane itself by a cable entering the centre of the crane hut, so as to allow of slewing The total height from the ground to the top of the highest jib was 140 ft, and a cumulative compound-wound 13 h p motor at 400 volts and 750 revolutions per minute raised a load of 2 to 3 tons, single purchase, through this distance in a little over a minute The length of the jibs varied from 50 to 75 ft, and these could be swung round an arc of 270°, giving a wide range of operations There was no objectionable variation of speed with load, as the motor required no controlling valves or levers, thus ensuring more ease and safety to the craneman When placed on scaffolds, the shear legs of the crane were secured by heavy chains run to the ground and weighted

For delicate adjustment the electric crane is invaluable, as it can raise a large block of stone weighing a couple of tons and place it in position with the greatest nicety, thus saving time and labour But with the steam crane no matter how expert the driver may be he is almost sure to admit too much steam to the cylinder which will raise the stone with a jerk, and probably carry it through too long a distance

those

raise

Home

Office thus effected an economy of 10*s* per week, while the electric energy only cost 14*s* per week as compared with £1 for coal To work a hand crane all day long costs 5*s* per horse power per hour, whereas electric power supplied from the city mains may be only 1*d* ditto An electric crane lifted all the material for a large building at Edinburgh, and the price of current from the corporation mains was only 4*s* per week The cost of coal for a steam crane doing similar duty was 20*s* to 25*s* per week The builders of the Glasgow University extension also installed an electric motor to drive an electric derrick crane, capable of lifting 5 tons at a speed

of 170 ft per minute and of covering a radius of 75 ft Current was obtained from the corporation supply inside the University grounds and was transmitted 250 yards

Electric Mortar Mills—On the Home Office again, the motors for the electrically driven mortar pans were situated in the small sheds into which were brought the services from the electric mains The motors themselves ran at 400 volts continuous current were shunt wound and drove the pans by belts It was found that for a week of 50 working hours the steam driven pan cost £2 for coal and £2 for labour whereas the total expenses in connection with the electrically driven pan did not exceed 25s under the worst conditions This was because the motor needed no attention whatever while at least one man was in constant attendance on the steam engine and because of the difference in cost between coal and electrical energy With the latter there was no fear of fuel or water giving out no getting up steam

inner hour,

night

oyal Liver

Building Liverpool during 1908 9 six electric hoists were used rising to nearly 300 ft above ground level Each motor developed 24 h p and the winch could raise loads up to 30 cwt at the rate of 200 ft per minute and 3 tons at proportionately lower speed The hoisting platform was 6 ft square of steel and wood Ordinary electric motor driven hoists will lift loads of 1 to 30 cwts at speeds of 50 to 150 ft per minute

Electric Motor

On each floor of the same edifice a system of 24 in gauge light rail way tracks was laid down for trans porting materials in steel wagons from the hoist platforms to where needed and an electrically driven circular saw was installed on the first floor to deal economically with the large quantities of timber

Electric Drills—These are portable light and easily conveyed for work done in position One of the most useful is the magnetic drill pillar which can be magnetised by an electro magnet at the base so that it sticks in any position to the metal being operated upon such as a steel girder This dispenses with all bolts clamps and fixing and the pillar sustains its own weight and that of a workman in addition

Cutting Piles by Electricity.—Heavy steel piles were cut with an electric arc in New York in 1906, which was much quicker and cheaper than the usual methods Connection was made with the street alternating current mains, a transformer reducing the pressure to 50 volts, and carbon electrodes used In a day of 8 hours 10 ft of piling were [illegible]

through a foot of piling per day

Cutting Metal with Oxygen—In Feb, 1911, a man engaged by the Knowles Oxygen Co cut through 42 15 in × 15 in R S girders at the Smallheath railway sidings Birmingham, in $4\frac{3}{4}$ hours Total cost was —

	s	d
Oxygen 200 cub ft at £2 per 1 000 cub ft	8	0
Hydrogen 300 cub ft at £1 do	6	0
Labour $4\frac{3}{4}$ hrs at 1s per hour	4	9
	42) 18	9
Cost per girder cut	0	$5\frac{1}{4}$

General Electric power can therefore be applied to any kind of tool or machine and its great advantages are convenience, flexibility greater speed and easy regulation, noiselessness unaffected by frost reliability and less risk, cheaper and more economical in working the electric current usually costing only 1*d* per unit from the mains motors [illegible]

gain by its numerous applications

CHAPTER IV.—PRELIMINARY AND PROVISIONS.

BEFORE proceeding to the various trades, it will be well [illegible] the above [illegible] these require [illegible] for other work Those items that do not require to be thus directed have been omitted

COPY OF QUANTITIES FOR ARCHITECT

"Extras and omissions to be valued at the prices of the contract, for which purpose a fully priced and money'd out copy of the quantities shall be deposited with the architect, and any item of extra work which does not exactly agree with descriptions of the original estimate to be valued at a price analogous thereto

This is understood, and it is not usual to enter any sum against such item, as the small extra expense is covered by the amount put down for "Cost of lithography and expenses" at the end of the bill of quantities

FOREMAN

"The contractor to keep an approved and responsible foreman constantly on the works

On no person connected with a building job does so much really depend as upon the foreman, for he is, in fact, the chief supervisor and general factotum It is to his intelligence and ability that all good work is due, as he is responsible for good or bad workmanship and materials, and for the diligence or slothfulness of the men under him He keeps the accounts of the quantity of stuff used, and renders the daily and weekly returns of the number of men employed, when there is no clerk of works Generally he rises from the ranks of the carpenters, but often from the bricklayers or masons The general prices are best calculated without

taking the foreman into account, and the cost of his maintenance should be kept separate In order that he may finish the works properly, rather more than the stated period of erection should be allowed for his wages, which may be averaged at £3 per week

In addition to the general foreman there is the foreman bricklayer &c and the timekeeper for a large job For extras when more than 10 men are employed the foreman s time may be also charged but when less are engaged one of the men usually receives an additional 1*d* per hour as leading hand and this is charged in the bill

Water for the Works

Allow for supplying water for all the works including fees temporary plumbing and storage of water

Water is always required on the works for mixing mortar, concrete wetting bricks plastering &c, and in provincial towns when supplied by a local water company, it is generally put down at about £4 or £5 per job of medium size If in country places the water can often be conveniently obtained from adjacent rivers or lakes or a well may have to be dug and the water drawn or pumped up in which case the use of the pump and hose must be included The hire of a 4 in to 6 in diam wrought iron contractor s pump is 2*s* per week after the third week plus 5*s* chain hire but a large contractor would possess his own plant of this sort Taking water supplied in London by meter at 11*d* per 1 000 gal, we have just ¼*d* for a yard of concrete at 25 gals per yard

London Water Supply—London was formerly supplied by eight water companies each publishing its own set of regulations and charges which differed extremely These have now been amalgamated and handed over to the Metropolitan Water Board under the London Water (Purchase) Act 1902 Application has to be made on prescribed forms obtained from the Supervisor s Office, 42 Southwark Bridge Road London S E, or the Clerk s Office Savoy Court Strand W C

By section 17 of the Metropolitan Water Board (Charges) Act 1907 and by a resolution of the Board dated 20th Dec, 1907 it was decided that instead of supplying water for building purposes by measure it was to be granted at the rate of 7*s* per £100 of the probable total or part cost of a building for which the water is supplied excluding

decorative, iron, or steel work not needing the use of water The scale for special building supplies is as follows —

CHARGES FOR SPECIAL SUPPLIES

	s	d	
Standpipe deposit	10	0	
Concrete in Bulk (for sewers &c)	0	1½	per cub yd
for Foundations	10	0	per £100 of contract
for Road making 3 in (or less)	1	1	per 100 sq yds
6 in	2	1	
9 in	3	2	
12 in	4	2	
Kerbing and channelling charged at above rates according to thickness of concrete used			
Grouting or 1 in floating	1	0	
Cement pitch grouting	0	6	
Flags (paving)	1	0	
Macadam roads (with or without steam roller)	1	0	
Engines &c (but not for mortar mills when separate building rate is paid)	1	0	per h p per week
Building Manholes	1	6	per rod of brickwork
	0	1½	per y c of concrete
Junction Boxes	1	6	per rod of brickwork
	0	1½	per y c of concrete or 6d each
Transformer Pits	1	6	per rod of brickwork
	0	1½	per y c of concrete or 6d each
Dusting Supplies	[illegible]		
Tramway Construction	[illegible]		
	£1		post foundations
Turncock s Time	The above charges include the Turncock s time except under special circumstances		

DOMESTIC SUPPLY CHARGES

Domestic Water Rate —5 % of the rateable value (section 8)

Rebates —A rebate of 20 % is allowed in respect of premises exempt from the payment of inhabited house duty and assessed at a rateable value exceeding £300 (section 9)

CHARGES FOR NON DOMESTIC SUPPLIES

SUPPLY BY MEASURE (SECTION 16)

	[illegible]	11d per 1 000 gals
[illegible]	[illegible]	10d
[illegible]	[illegible]	9½d
[illegible]	[illegible]	9d
500 000	1 000 000	8½d
1 000 000	3 000 000	8d
3 000 000	5 000 000	[illegible]d
5 000 000 gals.		6½d

METER RENTS (SECTION 18)

	s	d	
Meter diameter of inlet and outlet not exceeding ⅜ in	1	6	per quarter
½ in	2	0	
¾ in	2	6	
1 in	3	6	
1¼ in	4	0	
1½ in	5	0	
2 in	7	6	
3 in	10	0	
4 in	12	6	

Example —A detail of a building supply for a small £2 000 job would be as below as there must be added the expense of opening ground and reinstating connection temporary plumbing and contractor s profit The piping, &c , will revert to the contractor who merely charges for use and waste

ANALYSIS

	£	s	d
Cost of water 7s per cent on £2 000	7	0	0
Standpipe deposit official charge	0	10	0
Opening ground connection ferrule and stop cock and reinstating road and pavement	0	15	0
Use and waste only of say 30 ft run of ¾ in lead pipe at 4*d* per foot run	0	10	0
Use only of ball cock and removing on completion	0	1	0
Soldering joint of ¾ in lead pipe and ball cock	0	1	6
	8	17	6
Add 10 to 15 per cent profit say	1	2	6
TOTAL	£10	0	0

WATER FOR A PROVINCIAL JOB

When the work is in the country London rates will not apply and the cost of water will be computed according to the local charge of perhaps 6*d* to 1s 6*d* per 1 000 gals As water is mainly used for concrete wetting bricks mortar, plastering limewhiting &c the total number of gallons may be reckoned thus —

Allow roundly 25 gals	gross per	yd cube of concrete
500		rod of brickwork
50		yd cube of mortar
3		yd super of plastering 3 cts
¼		yd super of limewhiting 2 cts

Supposing the amounts of foregoing work, taken from the quantities to be 200 yds cube of concrete 40 rods of brick work [illegible]0 yds cube of mortar 500 yds super of plastering

and 160 yds super. of limewhiting, then a rough calculation would appear —

	Gals
200 yds cube concrete × 25 gals	5 000
40 rods brickwork × 550 gals	22 000
80 yds cube mortar × 50 gals	4 000
500 yds super plastering × 3 gals	1,500
160 yds super limewhiting × ¼ gal	40
	32 510
Add 25 per cent for other uses and waste say	8,160
Total water required	40 700

	£	s	d
Therefore 40,700 gals × 1s per 1 000 gals (local charge)	2	1	0
	1	0	0
	0	10	0
Use of water supplied by Water Company say	0	10	0
	4	1	0
Add 10 to 15 per cent profit say	0	9	0
Total cost for job	£4	10	0

FIRE INSURANCE

"*Allow for insurance from fire to the amount of tender,* and deposit the policy with the architect

to have buildings insured

provincial towns, where

all In the former, it is unusual to insure before the roof is on, or until some combustible material is fixed and then it is frequently stated for only two thirds the amount of contract A reasonable scale may be taken as below, to which the contractor may add his profit

Value	Three Months	Six Months	Nine Months	Twelve Months
For each £100 assured	1s 3d	1s 9d	2s 0d	2s 6d

NOTICES TO AUTHORITIES

"Allow for giving all notices to the local authorities, and for supplying any drawings or information required by them, and pay all fees"

Copies of local building by laws and regulations can be obtained on application at the borough surveyor's office, where tracings by the architect of the plans, showing drains,

&c, have to be deposited in time to be laid before the council or building committee for approval

In London there are 3 Governments—County Government City Government and Borough Government, thus—

1 County authority (the London County Council)

2 City authorities (the City Corporation and City Council of Westminster)

27 Borough authorities (Battersea, Chelsea, Hackney, Lambeth Poplar Southwark &c)

In so vast an area as the Metropolis the London Building Act of 1894 specially controls the erection of all buildings, which are subject to the supervision of the district surveyor appointed to the division in which the structure or building is situated Of these there are 53, and by par 145, Part XIII the notices to be given to the surveyor by the builder are—

145 In the following cases and at the following times, that is to say —

[illegible]

then two clear days before it is resumed and

(c) Where during the progress of a building or structure or work, the builder employed thereon is changed then two clear days before a new builder enters upon the continuance thereof

the builder (or other person causing or directing the work to be executed) shall serve on the district surveyor a building notice respecting the building or structure or work Every building notice shall state the situation area height number of stories

[illegible]

FEES TO DISTRICT SURVEYORS

The following are the fees payable to district surveyors under the Third Schedule of the same Act —

ON NEW BUILDINGS

	£	s	d
For any b[illegible] in area and not	0	10	0
[illegible] in area and not	1	10	0
[illegible]	0	5	0
[illegible] ection of a square	0	2	6
[illegible] ft in area and of	0	15	0

ON ADDITIONS ALTERATIONS OR OTHER WORKS	£ s d
For every addition or alteration or other work to which the provisions of this Act apply, made or done to or on any [illegible]	—
[illegible]	—
[illegible]	0 10 0
For inspecting the formation of openings in party walls (for each opening)	0 10 0
For inspecting the closing of openings in party walls (for each opening)	0 10 0
[illegible]	

There are also fees for chimney shafts and flues for certifying plans, and for attending at Court when an order is made on the builder for complying with the notice of irregularity The fees required for inspection of any wooden

[illegible] these by laws such fees to be payable in the manner and at the time prescribed by section 51 of the Metropolitan Building Act' 1855 Also an additional fee of 5s for artisans schemes under the London County Council (General Powers) Act of 1890

By the same Acts it is necessary to conform to the regulations of the various Metropolitan borough councils district boards and parishes chiefly as regards sanitary measures and connections to drains and sewers &c and plans must be sent in of the proposed systems The rules and charges are best obtained on application but those of St George s Hanover Square may be quoted as being fair and reasonable —

The parish connects drain with sewer inserting trap and two lengths of pipe at the following rate —

	£ s d
6 in	0 15 0
9 in	0 19 0
12 in	1 6 0

The builder digs and fills in

Watching and Lighting

Allow for any necessary watching and lighting

It is frequently desirable to keep on the premises a day watchman during non working hours and a night watch man to prevent theft of material The pay of such is 6½d per hour plus ½d per hour for use of lamp including oil and wick and his total period of watching can easily be calculated from the length of time put down for the completion of the building

If it is found necessary to perform work of any description by artificial light the contractor is allowed the cost of the *light only* in addition to the contract rates The Wells light and the Lucigen light which generate oil into vapour and burn it in large powerful flames are the artificial lights best adapted for contractors and general outdoor purposes as they are portable and self contained

Clerk of Works

Allow for an office for clerk of works and the requisite firing light and attendance and for all sheds &c required for materials

Contractors either erect a temporary wooden office on the site for the clerk of works or else have a small portable structure which can be taken about from their yard to the job The former would be knocked together from any old pieces of boarding and might cost £10 while if the latter were constructed of galvanised iron and consisted of one room about 8 ft by 8 ft it would come to about £15 when purchased new A small stove or fireplace would be required in the winter months for which allow 6d per day for fuel

For an office for clerk of works of wood 12 ft × 12 ft × 8 ft to collar with boarded floor window desk lock up drawers stove &c removal at completion of job and supplying light and coal during contract (18 months) a builder s

One or two rough wooden sheds may be necessary in which to store cement timber and other materials from the weather or to provide shelter for the masons when cutting out stone The number and size of these would entirely depend upon the kind of contract

MAKE GOOD ALL DEFECTS

"Allow for keeping the works in proper repair for six months after completion, and for making good all defects or ... during the

... ection by ... workmanship ...

ATTENDANCE ON EACH TRADE

"Allow for each trade to attend on all others and do all jobbing work required

Such a clause affects builders more in the North than in other parts of the kingdom, where the system of separate contracts for each tradesman obtains Each tradesman has to attend and make good the work of others, as when a bricklayer has to pin in the end of a beam with cement, or a mason cut a hole in a wall for a gaspipe and make good The charge for this item is very uncertain About £2 per £1,000 of work is a rough sort of guide but £5 is generally the lowest and the rise not proportionate to the amount of contract

CLEAR AWAY RUBBISH &c

"Allow for clearing away all dirt or rubbish and super

The cost of this is likewise speculative and would be

of flooring

SCAFFOLDING

"Allow for all scaffolding, profiles, rods, &c, and stakes and labour in setting out works

Though these come under the heading of Builders' Plant, scaffolding is more conveniently dealt with as a separate item in the cost of brickwork, and may be put down at 6s

... en the ... which

HIRE OF PLANT

Description		First Week Day	First Week Week	Second Week Day	Second Week Week	Third Week Day	Third Week Week	After Third Week Day	After Third Week Week
		s. d.	s. d.	s. d.	s. d.	s. d.	s. d.	s. d.	s. d.
Barrows, wheel, excavators	each	0 [illegible]	2 0	0 4	1 6	0 3	1 0	0 2	0 8
Blocks and falls of size ordered	per set	1 [illegible]	6 0	1 0	4 6	0 9	3 6	0 6	2 6
Blocks, pulley, differential, with chain		2 0	10 0	1 4	6 8	0 8	3 4	0 4	1 8
Boards, scaffold	per doz	0 2½	1 0	0 1½	0 8	0 1	0 4	0 0½	0 2
Cords, scaffold		0 2½	1 0	0 1½	0 8	0 1	0 4	0 0½	0 2
Crabs, hoisting, double purchase	each	3 0	15 0	2 0	10 0	1 3	5 0	0 8	2 0
Cramps, floor	"	1 0	5 0	0 10	4 0	0 8	3 6	0 4	1 0
Engine, portable, for pumping or other purposes, not exceeding 6 H.P., including coals and attendance	"	30 0	150 0	23 6	142 0	27 0	135 0	25 0	125 0
Engine, ringing, or crab pile, including rings for heads and every necessary article for driving piles	"	5 0	25 0	3 4	17 0	1 8	8 0	0 10	4 0
Jacks, screw, to lift 8 tons	"	0 7	3 0	0 5	2 0	0 3	1 0	0 1	0 6
Ladders, 20 rounds	"	0 6	2 0	0 4	1 4	0 3	1 0	0 2	0 8
" 40 "	"	0 9	3 6	0 7	2 6	0 5	2 0	0 4	1 0
" 60 "	"	1 0	4 0	0 10	4 0	0 8	3 0	0 5	2 0
Mill, mortar, with pan 5 ft. diam., &c.	"	10 0	50 0	0 8	33 0	3 4	17 0	1 8	8 0
Planks, wheeling	per doz	0 6	2 6	0 4	1 8	0 2	0 10	0 1	0 5
Poles, scaffold, under 22 ft. long	"	0 5	2 0	0 3½	1 4	0 2	0 0	0 1½	0 5
" over 22 ft. long		0 9	3 9	0 6	2 0	0 4	1 0	0 2	0 8
Pumps, Well, contractor's, 4 in. to 6 in. diam.	each	1 0	5 0	0 9	4 0	0 7	3 0	0 5	2 0
Putlogs	per doz	0 2½	1 0	0 1½	0 8	0 1	0 4	0 0½	0 2
Screens, 6 ft. × 3 ft. for gravel or sand	each	0 5	2 0	0 3½	1 4	0 1½	0 8	0 0½	0 4
Sieves	"	0 2	0 10	0 1½	0 7	0 1	0 4	0 0½	0 2
Tarpaulins	"	0 9	3 0	0 8	3 0	0 7	2 0	0 4	1 6
Trestles for two boards on top, 6 ft. high	"	0 7	2 9	0 5	1 0	0 4	1 3	0 2	0 9
" " 9 ft. "	"	0 8	3 3	0 6	2 3	0 5	1 9	0 3	1 0
Waggon, four wheel	"	3 0	15 0	2 0	10 0	1 0	5 0	0 6	2 6
Wagon or cart, two-wheel	"	2 0	10 0	1 4	6 8	0 8	3 4	0 4	1 8
Wedges, scaffold	per doz.	0 2½	1 0	0 1½	0 8	0 1	0 4	0 0½	0 2
Wheel and rope	each	0 9	4 0	0 0	2 8	0 3	1 4	0 1½	0 8
Wheels or pulleys, 12 in., contractor's rubbish, with frames complete and 150 ft. of rope	"	0 0	2 0	0 4	1 8	0 2	0 10	0 1	0 5
Winch (builders), with two wheels, and baskets and rope	"	4 0	20 0	2 8	13 4	1 4	0 8	0 8	3 4

NOTE.—Roughly, the cost of hiring per week may be taken at 1 per cent. of the full value

include delivery and depositing in position where directed, removal, wear, tear, and repairs

Lamps use of for night watchman including oil and wick	each ½*d* per hour	
Horse with proper harness in good working condition	, 8 *l*	,
Cart two wheel or water cart	2*d*	,
Wagon four wheel or timber carriage	3 *l*	,,

When the hiring is for more than one week, the price for the first week is allowed and the remaining time at a proportionate rate of the opposite table Fractions of a day *to be reckoned as a whole day*

Most contractors, however, do not rely upon hiring, except for special purposes, but usually possess their own plant, the list prices (exclusive of discount or profit) of some common articles being as follows —

PURCHASE OF PLANT

		£	*s*	*d*
Barrows excavators, stout ash with cast iron wheel	each	0	15	0
Brick crushers, the 'Clapton' No 1, with two fly wheels	,,	17	10	0
,, ,, No 2 ,,	,	22	10	0
		45	0	0
		60	0	0
		0	2	0
		9	0	0
		1	0	0
		80	0	0
		180	0	0
		4	0	0
	d	0	0	5
,, 18 not exceeding 30	,	0	0	6
,, 31 ,, ,, ,, 40	,,	0	0	7
,, 41 ,, ,, ,, 50	,	0	0	8
,, 51 ,, ,, ,, 60	,	0	0	8½
,, 61 ,, ,, ,, 65	,,	0	0	9
,, 66 ,, ,, ,, 70	,	0	0	10
,, 71 ,, ,, ,, 75		0	0	11
,, 76 80		0	1	1
,, 81 ,, ,, ,, 85	,,	0	1	4
,, 86 ,, ,, ,, 90	,	0	1	7
,, 91 ,, ,, ,, 95	,	0	2	0
,, 96 100	,,	0	2	6
,, painting three coats plain colour, extra	,	0	0	1½
iron bolts to, extra	each	0	0	6
Lewises chain from	,	*0*	*4*	*6*
stone, ,	,	0	5	6
Mills mortar, 5 ft diam pan, on wheels	,	52	0	0
Mortising boring and tenoning machine, complete	,	12	0	0
Picks and pickaxes	per cwt.	1	0	0

HIRE OF PLANT

Description		First Week Day	First Week Week	Second Week Day	Second Week Week	Third Week Day	Third Week Week	After Third Week Day	After Third Week Week
		s. d.	s. d.	s. d.	s. d.	s. d.	s. d.	s. d.	s. d.
Barrows, wheel, excavators	each	0 [illegible]	2 0	0 4	4 6	0 3	1 0	0 2	0 8
Blocks and fall, of size ordered	per set	1 [illegible]	0 0	4 0	4 0	0 9	3 6	0 6	2 0
Blocks, pulley, differential, with chain		[illegible] 0	10 0	1 4	6 8	0 8	3 4	0 4	1 8
Boards, scaffold	per doz.	0 [illegible]	4 0	0 4½	0 8	0 1	0 4	0 0½	0 2
Cords, scaffold		0 [illegible]	1 0	0 1½	0 8	0 1	0 4	0 0½	0 2
Crabs, hoisting, double purchase	each	2 0	4 0	2 0	10 0	1 3	[illegible] 0	0 8	2 0
Cramps, floor	"	4 0	[illegible] 0	0 10	4 0	0 8	[illegible]	0 4	1 0
Engine, portable, for pumping or other purposes not exceeding 6 H. P., including coals and attendance	"	30 0	1[illegible]0 0	[illegible] 6	142 6	[illegible] 0	135 0	25 0	125 0
Engine, ringing, or crab pile, including rings for heads and every necessary article for driving piles		3 0	2[illegible] 0	2 4	17 0	1 8	8 0	0 10	4 0
Jacks, screw, to lift 6 tons	"	0 [illegible]	3 0	0 [illegible]	3 0	0 3	1 0	0 1	0 6
Ladders, 20 rounds		0 6	2 0	0 4	1 4	0 2	1 0	0 2	0 9
" 40 "	"	0 9	3 6	0 [illegible]	2 0	0 [illegible]	2 0	0 4	1 0
" 60 "		1 0	[illegible] 0	0 10	4 0	0 8	3 0	0 5	2 0
Mill, mortar, with pan 5 ft. diam., &c.		10 0	[illegible]0 0	0 8	33 0	3 4	17 0	1 8	8 0
Planks, wheeling	per doz.	0 6	2 6	0 [illegible]	1 8	0 2	0 10	0 1	0 3
Poles, scaffold, under 22 ft. long	"	0 3	2 0	0 3½	1 4	0 [illegible]	0 9	0 1½	0 5
" over 22 ft. long	"	0 9	3 4	0 6	2 8	0 4	1 6	0 2	0 9
Pumps, hand, contractor's, 4 in. to 6 in. diam.	each	1 0	5 0	0 9	4 0	0 [illegible]	2 0	0 5	2 0
Putlogs	per doz.	0 2½	4 0	0 1½	0 8	0 1	0 4	0 0½	0 2
Screens, 6 ft. × 3 ft., for gravel or sand	each	0 5	2 0	0 3½	1 4	0 1½	0 4	0 [illegible]	0 4
Sieves	"	0 2	0 10	0 1½	0 7	0 1	0 4	0 0½	0 2
Tarpaulins	"	0 9	3 6	0 8	3 0	0 [illegible]	2 6	0 4	1 6
Trestles for two boards on top, 6 ft. high	"	0 [illegible]	2 4	0 5	1 6	0 4	1 2	0 2	0 9
" " 9 ft. "	"	0 8	3 3	0 6	2 3	0 5	1 [illegible]	0 3	1 0
Wagon, four-wheel	"	3 0	15 0	2 0	10 0	1 0	3 0	0 6	2 0
Wagon or cart, two-wheel	"	2 0	10 0	1 4	6 8	0 8	3 4	0 4	1 4
Wedges, scaffold	per doz.	0 [illegible]	1 0	0 1½	0 8	0 1	0 4	0 0½	0 2
Wheel and rope	each	0 9	4 0	0 6	2 8	0 3	1 4	0 1½	0 5
Wheels or pulleys, 12 in., contractor's rubbish, with frames complete and 100 ft. of rope	"	0 8	2 6	0 4	1 8	0 2	0 10	0 1	0 3
Winch (builders), with two wheels, and baskets and rope	"	4 0	20 0	2 5	13 4	1 4	6 8	0 9	3 4

NOTE.—Roughly, the cost of hiring per week may be taken at 1 per cent. of the full value.

include deli\ ery and depositing in position where directed, remo\ al wear tear, and repairs

Lamps use of for n ght watchman including oil and wick	each ½d per hour
Horse with proper harn ss in good working con d tion	8d
Cart t\ o wheel or \ ater cart	2d
Wagon four wheel or timber carr age	3d

When the hiring is for more than one week the price for the first week is allowed and the remaining time at a proportionate rate of the opposite table Fractions of a day to be reckoned as a whole day

Most contractors however do not rely upon hiring except for special purposes but usually possess their own plant the list prices (exclusive of discount or profit) of some common articles being as follows —

Purchase of Plant

		£	s	d
Barrows excavators stout ash with cast iron wheel	each	0	15	0
Brick crushers the Clapton No 1 with two fly wheels		17	10	0
No 2		22	10	0
		45	0	0
		60	0	0
		0	2	9
		9	0	0
		1	0	0
		80	0	0
6 H P single cylinder		180	0	0
Jacks screw to l ft 6 tons 2½ in d am screw with iron case 32 in h gh		4	0	0
Ladders 12 rounds and under	per round	0	0	5
13 not exceed ng 30		0	0	6
31 40		0	0	7
41 50		0	0	8
51 60		0	0	8½
61 65		0	0	9
66 70		0	0	10
71 75		0	0	11
76 80		0	1	1
81 85		0	1	4
86 90		0	1	7
91 95		0	2	0
96 100		0	2	6
painting three coats plain colour extra		0	0	1½
iron bolts to extra	each	0	0	6
Lewises cha n from		0	4	6
stone		0	7	6
M lls mortar 5 ft d ait pan on wheels		32	0	0
Morti ing boring and tenoning mach ne complete		12	0	0
P cks and pickaxes	per cwt	1	0	0

PURCHASE OF PLANT—*continued*		£	s	d
Handles for picks and pickaxes	each	0	0	10
Pulleys, London pattern W I pulley blocks, 6 in diam sheave, snatch		0	9	0
Ditto 6 in ditto 1 sheave		0	7	6
Ditto 6 in ditto 2 sheaves		0	11	0
Ditto 6 in ditto 3 sheaves		0	15	0
Pulleys, Weston's differential pulley block with guides tested to 1 ton		0	17	0
Pump W I galv contractor's 4 in diam suction pipe 7 ft long heavy		2	10	0
Ditto 6 in ditto		3	2	0
Putlogs hewn birch 6 ft long by 3½ in by 3 in		0	0	10
Rammers, earth		0	4	0
Rope tarred of any size required	per cwt	3	5	0
white European (any size required)		3	10	0
Scaffold boards iron bound 12 ft long	per doz	1	4	0
birch putlogs best		0	8	6
cords		0	12	0
poles 15 ft long	each	0	1	10
20 ft	"	0	2	8
25 ft		0	3	9
30 ft		0	4	3
35 ft		0	6	6
40 ft		0	7	0
45 ft		0	8	6
Screens builders for sand and gravel 5 ft 6 ft high ¾ in mesh		1	6	0
Shovels helved universal common		0	3	0
Sieves sand fine iron wire 18 in diam ½ in mesh		0	3	6
Spades helved common		0	2	6
Tarpaulins	per sq yard	0	2	0
Trestles 6 ft high for two boards	each	0	10	0
9 ft		1	2	0
Trowels bricklayer's 12 in		0	2	6
Wells Light No 1 (Hand pattern) 1,500 candle power complete		10	0	0
Wheels or pulleys rubbish 12 in diam for 1 in rope		0	12	0

Builders wishing to buy or dispose of spare plant would do well to consult Phillips' Monthly Machinery Register, Newport, Mon, wherein second-hand machinery and plant of all kinds are advertised for sale or hire. Insertions are free, but a commission is charged if a purchaser is found thereby.

SCAFFOLDS

The Court of Common Council, under the City Corporation, have instructions and fees for scaffolds (as well as for hoards, raking shores, &c) within the City of London, and issue licenses. These are called the Regulations of the Public Health Department of the Corporation. No *scaffold or* board is to project beyond the footway pavement where it is

narrow, nor more than 6 ft where it is wide enough to admit of such projection Each stage to have fan and edge boards and other such precautions to prevent dirt or wet falling upon the public Under Section III the following are the

FEES FOR LICENSES FOR SCAFFOLDS

			s	d
If to remain not more than 2 weeks per foot lineal of frontage			0	4
If over 2 weeks and not more than 4 weeks		per foot lineal	1	0
4	8		3	0
8	12		6	0
12	16		10	0
16 weeks for every month or part of a month			5	0

No fee to be more than £10 without the right to advertise

HOARDINGS

be
req rks
wit tion
of with
two returns

The regulations of the Court under Section III state that hoards within the City of London must not have doors opening outwards to interrupt foot passengers and that where needed a boarded platform 4 ft wide and as much wider as may be necessary for the traffic with stout posts rails and wheel kerbs on the outside of it are to be constructed outside the hoard as may be directed The license for hoarding rises to over 5s per foot run per month but an average charge is 2s 6d per month About 50s, say, for every £1 000 of work is a rough estimate That below is the proper scale —

FEES FOR LICENSES FOR HOARDS

			s	d
If to remain not more than 2 weeks per foot lineal of frontage			0	6
If over 2 weeks and not more than 4 weeks		per foot lineal	1	6
4	8		4	6
8	12		J	0
12 weeks for every month or part of a month			5	0

No fee to be more than £10 without the right to advertise

In addition to the above scale of fees the following payments have to be made for the right to advertise —10s per 100 ft super per month in first class streets and 5s ditto

... y of his old stuff, including

cartage to site, fixing and removal A board of the usual height of 7 ft is worth 1s 10d per foot run, plus 9d per foot run for the fan over, plus 1s 5d per foot run for a 4 ft wide planked footway and rail fence—or, say, 4s per foot run complete for the three items added together Speculative contractors put down 12s to 15s per square for the boarding only This includes wear and tear and profit A more precise method of estimating this item is to take out quantities of all the stuff, and price for use and waste only, as before stated

FEES FOR LICENSES FOR HAKING SHOPS

		£	s	d
If to remain not more than 2 weeks	each	0	5	0
If over 2 weeks and not more than 4 weeks	„	0	15	0
4 8 „	„	2	0	0
8 12	„	4	0	0
12 weeks for every month or part of a month	„	2	0	0

The use and waste of shoring may be priced at 1s 3d per foot cube including labour, wedges, spikes, hoop iron, removal, and profit

PROVISIONS

"Provide the following sums to be expended as directed, or to be deducted in full if not required If contractor desires a profit he must add it to the amount named in each case, and he must allow for packing carriage and fixing P C, or net cost, shall mean the net cost after deducting from the merchant s list price the trade discount, but not the discount for cash

The above cases are only typical ones and provisional amounts may be inserted for anything The object of thus stipulating that the contractor shall provide a certain sum of money in his tender for a particular purpose is to avoid

exactly what has to be done, as in foundations, drains, roads, &c On the adjustment of these sums there is much misunderstanding unless there is a clear definition as to prime cost, inclusion or exclusion of profit deduction

of sum if article is not required, error in extending the provisional amount in the money column of the priced bill of quantities, &c The best way to guard against any future difficulty is to carefully word the clause relating to these provisions in some such manner as described at the beginning of this item The definition of "prime cost," in particular is frequently loosely specified, or even omitted altogether, leading to a dispute between the architect and builder as to whether P C means *list* prices or net cost after deducting the trade discount from these list prices

Lt Colonel T S Jerome, F S I, Chief Inspector of Works, War Department, stated in the *Building News* of October 8th, 1897, that "A provisional sum in a bill of quantities should always be considered a fixed one, entirely under the control of the architect or surveyor, no matter how it has been treated by the contractor If he ignores it (and probably obtains a contract by so doing), is the client to have the cost of his building increased, if the provisional work be executed, or suffer by it not being done, through a contractor's negligence or wilfulness? If a provisional sum be magnified, it militates against the tender being the lowest, if it became a rule to deal with the 'extended' sum (if it
ount), difficulties must arise
ictor shall provide a certain
something (seen or unforeseen) to be done, nothing more, nor less, should be considered when squaring up the contract, whether he increases, reduces or omits it, is entirely his affair In the quantities for the erection of a large public institution, in a suburb of London, the provisional sum of £2,000 was inserted for carving The contractor omitted to 'extend' it, nevertheless the carving was executed, and no extra was allowed"

CHAPTER V.—EXCAVATOR.

MEMORANDA

Capacity of Carts, &c

An ordinary one horse cart 6 ft × 3½ ft × 2¼ ft, holds 45 cub ft or	1⅔	yds	cube
A builder's cart holds of earth sand rubbish &c	1	"	"
A tumbrel or tipping cart	1½	"	"
A dobbin or three wheel cart	⅔	"	"
A skip or earth bucket	1	"	"
An earth or tip wagon large, heaped	3	"	"
filled to level of sides	2⅔	"	"
An earth or tip wagon small, heaped	2¼	"	"
filled to level of sides	2	"	"
A wheelbarrow navvy's (large) holds 50 bricks, or 4 hods mortar, or	$\frac{1}{10}$	"	"
" ordinary holds 36 bricks, or 3 hods mortar, or	$\frac{1}{15}$	"	"
" light holds 29 bricks, or 2½ hods mortar, or	$\frac{1}{18}$	"	"
A basket holds 1 bushel or	$\frac{1}{27}$	"	"
The average earth wagon holds	50 barrow loads		
An empty cart weighs	about ½ ton		
A stone truck or wagon, holds	8 to 10 tons		
A two horse railway van holds	2 " 2½ "		
A railway truck or wagon, 15 ft 6 in × 7 ft 8 in, × 1 ft 6 in high	8 " 10 "		
	90 " 120 "		

2 yds cube of 54 ft cube, or

1 yd cube of 27 ft cube or

"	"	=
"	"	=
"	"	= cube heaped up
"	"	= 30 cwt lime mortar = 1 yd cube
"	"	= 31 " cement mortar 1 yd cube
"	"	= 10 bags of 2 bushels each = 1 ton Portland cement
"	"	= 5 barrels (400 lbs × 5 = 2,000 lbs net) Portland cement
"	"	= 14 ft cube, or 1 ton, solid stone
"	"	= 20 " " " road metal gravel or shingle
"	"	= 50 " " coke breeze ¼ in mesh
"	"	= 50 " " squared timber, or light woods
"	"	= 40 " unhewn heavy

Capacity of Carts &c —continued

A single load = 50 ft cube wood block paving
,, 40 filled or heavy cases
,, ,, = 80 light bulky articles (empty cases &c)
,, 12 squares flooring 1½ to 2 tons
30 bundles of laths ¾ to ½ ton
,, = 72 scaffold boards 12 ft long each
35 scaffold poles, 25 ft each (by van and horse)
,, 20 blocks asphalte 18 in × 15 in × 6 in 1 ton
500 ordinary bricks 1½ tons
,, 400 glazed 1¾
,, = 170 paving tiles 12 in × 12 in × 1½ in = 1 ton
1 000 6 in × 6 in × ⅝ in = 1 ton
,, 1 000 plain roofing tiles 1 ton
1 000 Countess slates 1st quality 1¾ tons
150 ft sup 1 in slate 1 ton
,, 1 butt water 224 gals 36 ft cube = 1 ton
1½ yds cube manure

Size of Barges

Monkey barge capacity about	25 tons
Canal barge	60
River barge	00
Thames lighter	100
Sailing sea barge	150

Weight of Soils

Soil	Weight per f c	Weight per Bushel 1·284 f c	Weight per y c	F c per Ton
	lbs	lbs	cwt	ft cub
Vegetable earth	70	90	16	32
Top soil	100	128	24	22
Common earth	110	141	26½	20
Clay	120	154	29	19
Gravel	116	149	28	19
Shingle	100	128	24	22
Thames ballast	112	144	27	20
Fine sand dry	95	122	23	23½
wet	110	141	26½	20
Coarse sand dry	100	128	24	22
wet	120	154	29	19
Loam	90	115½	21½	25
Marl	115	147½	28	19½
Mud	110	141	26½	20
Dry peat	40	51	9½	56
Wet peat	60	77	14½	37
Chalk solid	130	167	31	17
Granite	170	218	41	13
Limestone	155	199	37	14½
Quartz	165	212	40	13½
Sandstone	145	186	35	15½
Shale	165	212	40	13½
Slate	175	225	42	13
Trap	170	218	41	13

Safe Loads on Soils

	Tons
Alluvial or light earth	½ to ¾ per ft sup
Made earth consolidated	¾ „ 1
Ordinary firm earth	1 „ 1½ „
Compact earth, or soft clay	1½ „ 2
Chalk, soft to hard	1 „ 3 „
Sand, loose to compact	1 „ 4
[illegible]	4 „ 6 „
	2 „ 4 „
	2 „ 5 „
	4 „ 7 „
Rock, soft to hard	4 „ 10
Timber piles 12 in square	10 „ 60 „

Factor of Safety —⅓ to $\frac{1}{10}$ crushing weight

Trenches without Timbering

Depths to which trenches may be cut in various soils without timbering the sides —

Stiff clay	9 to 12 ft
Drained loam	5 „ 8 „
Ordinary earth	2 „ 3 „
Dry sand or gravel	1 „ 2 „

Natural Slopes

Natural slopes of earth from the horizontal *i e*, angles at which thrown up soils will stand of their own accord without slipping —

Soil	Angle of Repose	Base of slope to Height
Clay, dry	29°	1¾ to 1
„ damp, well drained	45°	1 „ 1
„ wet	16°	3½ „ 1
Earth consolidated	45°	1 „ 1
„ vegetable dry	29°	1¾ „ 1
„ „ moist	45°	1 „ 1
„ „ very wet	18°	3 „ 1
„ „ punned	63°	½ „ 1
Gravel, clean	45°	1 „ 1
„ with sand	26°	2 „ 1
Peat	33°	1½ „ 1
Sand fine dry	31°	1¾ „ 1
„ wet	26°	2 „ 1
„ very wet	31°	1¾ „ 1
Shingle loose	33°	1½ „ 1

Well drained earth will stand in embankments about 1½ horizontal to 1 vertical or say 33°

Turfing

Sods should be cut from meadows growing thick grass Dimensions of sods depend on width of spade common sizes being 24 in $\times$ 12 in $\times$ 3 in, or 18 in $\times$ 9 in $\times$ 4½ in 3 men will cut 100 sods per hour

Sowing Grass Seed

1 bushel of meadow grass seed = 15 lbs = 15 quarts = 11½ lbs per ft cube For sowing allow 2 bushels per acre

Bulk when Dug

Increase—Proportion of increase in bulk of soils when excavated and thrown into a loose heap —

	Before Digging	When Dug
Clay	1	1¼
Earth	1	1¼
Gravel	1	$1\frac{1}{10}$
Sand	1	1⅛
Road metal	1	1½
Chalk depending on size of pieces	1	1¼
Rock	1	1½

Settlement—Conversely, excavated soil will settle down and eventually shrink to its original bulk before digging A common allowance for settlement is 1 in for every foot of height, but sometimes as great as 3 in or $\frac{1}{12}$ to $\frac{1}{4}$ height

Proportion of Labourers

Proportion of excavators shovellers, and wheelers (up to 2 barrow runs) —

Soil	Excavators or Getters	Shovellers or Fillers	Wheelers or Removers
Loose sand and mould	1	2	2
Marl	1	2	2
Compact earth	1	1	1
Gravel	1	1	1
Hard clay	2	1	1
Rock	3	1	1

Rate of Cutting—The rate at which a cutting may be expected to advance, for each line of wheelers or for each shoveller in one rank, will be —

20 yds cube of loose sand or mould per day
16 yds. cube of compact earth or clay per day

Labour in Digging, &c

Description	An Excavator can Dig and Throw out— Per Day	Per Hour	Hours of Excavator No
Surface Digging	yd sup	yds sup	per yd sup
Soft ground for agricultural purposes 8 to 10 in deep	200 to 220	23	$\frac{1}{23}$
Common soil not exceeding 12 in deep	20 22	2¼	[illegible]
Over Areas	yds cub	yds cub	per yd cub
Loose soil or sand	15 to 17	1¾	$\frac{9}{16}$
Made ground or light soil	13 15	1½	⅔
Common ground	9 10	1	1
Stiff clay or gravel	5 7	⅔	1½
Hard ground where picking is required	5 6	⅝	1⅔
Chalk or lime concrete	3 5	½	2¼
Hard rock requiring blasting	1½	⅙	6
In Trenches			
Made ground	12	1⅓	¾
Common ground	8	⅞	1⅛
Clay or gravel	5 to 6	⅝	1⅝
Chalk or lime concrete	3	⅓	3
Hard rock requiring blasting	1	⅑	9
Throwing out beyond one throw in made ground	30	3⅓	$\frac{3}{10}$
Throwing out beyond one throw in common ground	20	2⅓	$\frac{9}{20}$
Throwing out beyond one throw in clay or gravel	15	1⅔	⅗
Filling &c			
Return and fill in common soil without ramming	18 to 22	2¼	$\frac{9}{20}$
Ramming ditto in foundations	18 22	2¼	$\frac{9}{20}$
Working or tempering puddle clay	3	⅓	3
Spreading and ramming ditto	3	⅓	3
Removing not exceeding 25 yds and depositing including filling barrows	35	4	¼
Removing not exceeding 50 yds and depositing including filling barrows	17	1⅞	$\frac{9}{17}$
Filling carts common soil	20 to 22	2⅓	⅜
Levelling common soil from heaps without throwing	60	6⅔	⅙

Working day taken at 9 hours 49 *yds sup* = 1 *rood of surface* digging in the country

PILING MEMORANDA

TIMBER PILES

Maximum length to avoid bending	20 diameters
Practical market limit of length	45 ft
	30 in
	¼ ton per f e
12 in piles	15 to 20 lbs
	piles
n straps for	
	18 to 21 in
Weight of C I shoe, with W I straps for 12 in square piles	20 to 25 lbs
Theoretical weight of shoe	$\frac{1}{100}$th pile
Connecting timbers for tops of piles	12 in × 6 in

SCREW PILES

Maximum diameter of screw piles	30 in
Thickness of metal if hollow stem	1 to 2 in
Ratio of screw disc to stem of pile	2 to 1
An ordinary ratio of screw to stem	57 to 30 in

REINFORCED CONCRETE PILES

Greatest length of reinforced concrete piles	60 ft
Proportion of concrete ½ to 1 in gauge for ditto	1 to 3 or 4
Thickness of external concrete covering	1 in
Percentage of steel per section of pile	2½ to 5 %

SAND PILES

Ordinary diameter of hole or sand filling	6 in
Usual depth of ditto	6 ft
Depth frequently number of diameters	6 to 12

SHORT PILES

Length of short piles to compress soil	6 to 12 ft
Diameter of ditto ditto	6 in
Distance apart centre to centre	30 in
Displacement of soil by ditto	50 to 75 %

SHEET PILES

Common size of wooden sheet piles	12" × 6 or 9" × 3
Distance apart of guide or king piles	5 to 10 ft
Thickness of elm sheeting for coffer dams	2 or 3 in

DRIVING OF PILES

	2 to 5 cwt
	40 lbs
	3 or 4 ft
	20 to 40 cwt
	5 ft
	10 ft
	15 to 20
	8 ft
	¾ in
	1 in

Labour in Digging, &c.

Description	One Excavator can dig and throw out—		Hours of Excavator
	Per Day	Per Hour	No.
Surface Digging	yds sup	yds sup	per yd sup
Soft ground for agricultural purposes 8 to 10 in deep	200 to 220	23	$\frac{1}{23}$
Common soil not exceeding 12 in deep	20 to 22	$2\frac{1}{3}$	[illegible]
Open Areas	yds cub	yds cub	per yd cub
Loose soil or sand	15 to 17	[illegible]	[illegible]
Made ground or light soil	13 to 15	$1\frac{1}{2}$	[illegible]
Common ground	8 to 10	1	1
Stiff clay or gravel	5 to 7	[illegible]	$1\frac{1}{2}$
Hard ground where picking is required	5 to 6	[illegible]	[illegible]
Chalk or lime concrete	3 to 5	[illegible]	$2\frac{1}{4}$
Hard rock requiring blasting	$1\frac{1}{2}$	[illegible]	6
In Trenches			
Made ground	12	$1\frac{1}{3}$	[illegible]
Common ground	8	[illegible]	[illegible]
Clay or gravel	5 to 6	[illegible]	[illegible]
Chalk or lime concrete	3	[illegible]	3
Hard rock requiring blasting	1	[illegible]	9
Throwing out beyond one throw in made ground	30	$3\frac{1}{3}$	$\frac{3}{10}$
Throwing out beyond one throw in common ground	20	[illegible]	[illegible]
Throwing out beyond one throw in clay or gravel	15	[illegible]	[illegible]
Filling, &c.			
Return and fill in common soil without ramming	18 to 22	[illegible]	[illegible]
Ramming ditto in foundations	18 to 22	[illegible]	[illegible]
Working or tempering puddle clay	3	$\frac{1}{3}$	[illegible]
Spreading and ramming ditto	3	$\frac{1}{3}$	3
Removing not exceeding 25 yds and depositing including filling barrows	35	4	$\frac{1}{4}$
Removing not exceeding 50 yds and depositing including filling barrows	17	[illegible]	[illegible]
Filling carts common soil	20 to 22	$2\frac{1}{3}$	[illegible]
Levelling common soil from heaps without throwing	60	[illegible]	[illegible]

Working day taken at 9 hours digging in the country. 49 yds sup = 1 rood of surfa[ce]

Piling Memoranda.

Timber Piles

Maximum length to avoid bending	20 diameters
	45 ft
	30 in
	1 t n per f s
12 in piles	15 to 20 lbs
	piles
n straps f r	
piles	18 to 21 in
Weight of C I shoe, with W I straps for 12 in square piles	20 to 25 lbs
Theoretical weight of shoe	$\frac{1}{4}$th pile
Connecting timbers for tops of piles	12 in × 6 in

Screw Piles

Maximum diameter of screw piles	0 in
Thickness of metal if hollow stem	1 to 2 in
Ratio of screw disc to stem of pile	3 to 1
An ordinary ratio of screw to stem	57 to 30 in

Reinforced Concrete Piles

	60 ft
ditto	1 to 3 or 4
	1 in
	2½ to 5 %

Sand Piles

Ordinary diameter of hole or sand filling	6 in
Usual depth of ditto	6 ft
Depth frequently number of diameters	6 to 12

Short Piles

	6 to 12 ft
	6 in
	30 in
	50 to 75 %

Sheet Piles

Common size of wooden sheet piles	12″ × 6″ or 9″ × 3″
Distance apart of guide or king piles	5 to 10 ft
Thickness of elm sheeting for coffer dams	2 or 3 in

Driving of Piles

	2 to 5 cwt
	40 lbs
	3 or 4 ft
	20 to 40 cwt
	5 ft
	10 ft
	15 to 20
	8 ft
	½ in
	1 in

SAFE LOADS ON 12 IN PILES

(At least 20 ft in ground and not free to bend.)

In ooze or muddy sand	9 tons
Moderately compact clay	12
Soft ground	13
Hard clay	25
Firm ground	[illegible]
Hard gravel	80
Safe load on 40-ft pile (different authorities)	10 to 60 tons
Factor of safety ditto (ditto ditto)	2, 12 ,,

PRICES

The following prices include labour, material, profiles, rods, profit, &c —

EXCAVATING, &c

Description		Made Ground [illegible]		[illegible]		[illegible]	
		s	d	s	d	s	d
Dig throw out and form surfaces not exceeding 12 in deep	per y s	0	1	0	5	0	6½
Trimming and levelling earth to surface for pavings &c		0	1½	0	2	0	2½
Digging and throwing out over areas exceeding 12 in deep including levelling	per y c	0	9	0	11	1	[illegible]
Ditto in trenches up to 30 in wide including levelling bottom and fixing and removing shoring and close planking where required not exceeding 6 ft deep		0	11	1	2	1	6
Extra for each additional 6 ft in depth the first 6 ft being paid for under last item		0	3½	0	5	0	6½
Add to last if in shafts tanks or cess pits		0	1¼	0	2	0	2½
Spreading and levelling in layers not exceeding 12 in deep		0	1	0	1½	0	2
		0	1½	0	2	0	3
		0	6	0	7½	0	9
		1	3	1	6	2	0
Labour and water only in forming puddle walls filling to coffer dams lining reservoirs &c with clay well worked and rammed in 6 in layers		—		—		4	0
Add if not exceeding 12 in thick		—		—		0	6
Clay clean yellow, for foregoing puddle		—		—		5	6

Excavation & ...

Description	
Neatly trimming surfaces of ... 3 in thick	per ...
Forming and trimming surfaces of embankments to neat face ... 1 in 4	
Digging for post holes under ½ yd ... including filling in and ramming	each

First use and waste of timber ... excavation including ... and removal
Ditto in planking of required thickness, ... (For subsequent use take one half ... each time)
Handpacking any thickness with rubble ... behind walls including wheeling under 50 yds
Selecting ditto and wheeling and ... with ...
Hard core or dry rubbish filled in and rammed

Removing

Description				
Removing not exceeding 50 yds and depositing at a level not exceeding 5 ft above starting point including ...	per y c	0 8	[illegible]	[illegible]
		0 1½	[illegible]	[illegible]
		0 10	1 [illegible]	[illegible]
		0 1	0 1	[illegible]
		0 1½	[illegible]	[illegible]
		0 7	[illegible]	[illegible]
		0 3	0 4	[illegible]
		2 0	2 [illegible]	[illegible]
		1 0	1 0	1 0

		s	d
Horse cart and driver	per day	12	0
Two horses cart and driver		17	6
Loading or unloading barges or boats placed alongside the material being delivered within 10 yds of side of barge	per ton or load	0	8
Ditto ditto tide work		0	10
Removing by barges or boats at a distance of 1 mile or under		1	0
Add for every additional mile or part of a mile beyond the first		0	6

Turfing

		s	d
	per y c	5	6
t ex	per y s	0	3
onable size and rolling and stacking for use	per 100 fs	1	4
Grass sods 24 in × 12 in × 3 in supplied only and delivered		5	0
Laying sods and twice beating labour only		2	0
Rolling grass surfaces with horse roller		0	0½
with hand roller		0	1
uding cost of		0	0½
		0	0¼
	per bushel	18	0
y sowing ditto	per acre	3	6
Mowing including raking into heaps	„	6	0

Sinking Wells and Boring

Description		Earth Clay or Gravel s	d	Solid Chalk &c s	d
Sinking for wells of any diameter including all timbering tackle &c keeping out water and moving the stuff to any distance not exceeding 50 yds for any depth not exceeding 20 ft	per y c	4	3	5	3
Ditto exceeding 20 and not exceeding 40 ft deep		5	6	6	6
40 — 60		6	6	7	6
60 — 80		7	6	8	6
80 — 100		9	0	10	0
Curbs paid under carpenter					

Boring		Boring only 4 in s	d	6 in s	d
Boring for water &c through earth clay or gravel (including removing the stuff not exceeding 50 yds) for any depth not exceeding 20 ft	per ft run	4	6	5	6
Ditto exceeding 20 and not exceeding 40 ft deep		5	0	6	0
40 — 60		6	0	6	9
60 — 80		8	0	9	0
80 — 100		10	6	11	6
Including insertion of pipes		1	0	1	6

SINKING WELLS AND BORING—*continued*

		s	d
Pumping water by hand from excavations, &c including all labour, use of pumps, stages, and plant net quantity lifted to be paid for, height under 20 ft	per 1,000 gals	1	6

PILING.

Fir piles, including heading, pointing, and driving complete	per ft cube	3	6
" " cut to lengths, and planting in position, timber only	"	2	3
" " small, under 9 in square and under 10 ft long ditto	"	2	5
Beech small piles, and ditto, ditto	,	3	9
Beech cap sills and ties to groynes, framed and spiked	"	4	6
Driving whole piles (portion in ground only measured)	"	1	0
Driving sheet or small piles, under 9 in square, and ditto	"	1	3
[illegible]	"	0	7
[illegible]	"	0	5
[illegible]	,	0	6
[illegible] 6 in spikes	per ft sup	0	10
3 in elm planking, rough, edges shot and fixed with 7 in spikes	"	1	4
Heading and pointing piles where rings and shoes not required, including cutting off heads after driving	per pile	2	6
[illegible]		5	0
[illegible]	per ft deep	7	6
		11	0
[illegible] screw piles	per job	20	0
Hand pile-driver, including 40 ft frame, ram winch, chain, &c , complete	each	£50	
Steam pile driver, ditto, with boiler, engine &c	,	£300	

WAGES

		s	d
Wages, excavator	per hour	0	$7\frac{1}{2}$
" ganger	,	0	8
" carter or driver	,	0	$6\frac{1}{2}$
" general labourer	,	0	7
" navvy		0	$7\frac{1}{2}$
" watchman, day or night	"	0	$6\frac{1}{2}$
" diver, under water in 2 shifts of 4 hrs each	"	2	6

ANALYSIS

Excavating, &c. Labour of Earthwork

The operations comprised in earthwork usually are —

1.
2.
3. wagons
4.
5.

Ground to be excavated may in general terms be classed as follows —

1. Loose earth, made ground, sand, or mud, that can be lifted with a shovel without digging.
2. Common ground where nothing more is necessary beyond cutting with a spade, an operation called "cutting."
3. Stiff earth, clay, gravelly soil, or loose chalk, that require getting by means of a pickaxe, an operation termed "hacking."
4. Rock and other hard ground, which requires to be blasted.

Most earths require cutting and hacking and some need all the above operations. One excavator to 5 ft. or 6 ft. breadth of face of a cutting is as near as they should be for efficient working.

Excavator's wages have been taken at $7\frac{1}{2}d.$ per hour, but digging is usually done by common labourers at $7d.$ per hour, or even less, in which case a saving would be effected in the following prices. For large excavations where much plant is required the digging is frequently sub-let, and a cheap way is by letting it by piecework to a gang of labourers.

In connection with excavation it is interesting to learn that the word "navvy" is a corruption of "navigator." They were called navigators because before the time of railways they were employed in the construction of navigable canals.

Typical specimens only of analyses have been shown in this book; other items and rates can be deduced in a similar manner from the information herein given, with the assistance of the tables of labour constants found in Hurst's "Architectural Surveyor's Handbook." The profit in this and other trades has been added separately to each individual item for the sake of clearness, though it does not follow that the same percentage wo[illegible]

Dig, throw out, an[illegible] *ing,* *&c., not exceeding* 12 [illegible] to be able to dig out 21 yards super of common soil, not

exceeding 12 in thick in a day of 9 hours Wages 7½d per hour Therefore he can execute 1 yard super in $\frac{1}{21}$st of that time

	s	d
Wages 7½d per hour × 9 hours = 67½d or 5s 7½d per day		
21 yards super are dug in one day $\frac{5s\ 7\frac{1}{2}d}{21}$ = per yard super	0	3¼
Add for profiles rods &c	0	1
	0	4¼
Add 20 per cent profit &c	0	0¾
Total price per yard super	0	5

Or this might be put 21 yards super are dug in a day of 9 hours or 1 yard super per $\frac{3}{7}$ hour therefore—

	s	d
1 yard super per $\frac{3}{7}$ hour at 7½d per hour say	0	3¼
Add for profiles rods &c	0	1
	0	4¼
Add 20 per cent profit &c	0	0¾
Total price as before	0	5

Digging and throwing out over Areas above 12 in in Depth including levelling Surface or forming Falls —A man would dig and throw out about 9 yards cube per day in common ground therefore—

	s	d
Wages 7½d per hour × 9 hours = 5s 7½d per day 9 yards cube are dug in 1 day $\frac{5s\ 7\frac{1}{2}d}{9}$ =	0	7½
Add for profiles rods &c	0	1½
	0	9
Add 20 per cent profit &c	0	2
Total price per yard cube	0	11

In made ground or light soil a man would dig 13 to 15 yards in clay or gravel 5 to 7 yards a day and in chalk 3 to 5 yards these being averages In hard ground where picking is required from 5 to 6 cubic yards would be excavated and 1½ yards hard rock requiring blasting Such data being known the prices for various soils can be analysed and worked out in the same way as the foregoing

Steam Excavating —The following has been condensed from an interesting article on Steam Excavators, by Mr

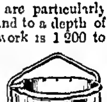
Arthur Bowes A M I C E which recently appeared in the *Building World* —

The Ruston Proctor machine will do as much work as 60 or 7
2d
the
Ruston Proctor machine with buckets of $1\frac{1}{2}$ yards cube capacity removed 67 yards cube per hour of soft running sand and silt at a cost of $6\frac{1}{2}d$ per yard cube which included tipping on spoil bank Although 1 100 yards cube per day of 10 hours have been done by these machines 600 to 700 yards is a fair average

A Wilson excavator will dig 400 to 630 yards cube per working day at a rate of 1*d* to 6*d* per yard delivered into

French and German steam excavators are particularly useful for digging in light soil or stiff clay and to a depth of 16 or 20 ft at a time The average day s work is 1 200 to 1 500 yds cube at a cost of 5*d* per yard They require 35 men in attendance

Stationary or travelling steam cranes may be employed to work iron or wooden skips which are like large buckets or boxes respectively and hold about 1 yard cube made to discharge from the crane over a wagon Woodford s patent iron skips are best


Iro k p

In working grabs the cost in some cases may be taken as about half the price of hand labour the saving is greater when under water When dredging Limerick harbour with a Priestman s grab the average cost of dredging and discharging was $1\frac{3}{4}d$ per ton

Large Earthworks —A modern steam excavator with a $1\frac{1}{2}$ yd cube bucket working in easily filled ground and under favourable conditions can average per 10 hour day measured in the solid —

550 to 650 yds cube		in ordinary ground
450	550	fairly stiff clay and shingle
350	450	strong ground with occasional rock

One steam excavator requires at least one locomotive to look after it, with speed not more than 8 to 10 miles per hour for sets of 30 to 40 wagons, with stops of 15 to 20 minutes not more than 4 miles apart for "fatting" Allow ¼ hour at one end and ¼ hour at the other for running round the wagons, getting coal and water, and shunting out crippled ones End tipping wagons hold 2½ yds cube and side tipping wagons 3 yds cube, measured in the solid Maintaining them in good running order costs ½d to 1d per yd cube per mile

[illegible]

To this add foreman boy turning points, general expenses 30 per cent, interest and depreciation 1 ton of coal, repair accounts, water, oil and stores or £2 10s, making a total cost per shift of £3 10s Washing and repairing engine while in shed adds 20 per cent to wages paid for actual driving

The foregoing is an abstract from articles on the "Cost of Excavation on Large Engineering Works" which appeared in the *Engineer* of 23rd and 30th June, 1911

Rock Dredging —The actual cost per yard cube of rock dredging on the Manchester Ship Canal, during April, 1907, by the Lobnitz rock breaking dredgers is given below The price of one rock cutter is £6 800, and if 4 per cent is allowed for interest and 2½ per cent for depreciation the additional cost per yard cube is 2¼d as added 17,060 cubic yards were broken the rock being sandstones of varying hardness, with some stiff marl

	s	d
Breaking excluding cost of plant but including maintenance and repairs	0	5¾
Dredging	0	5½
Barging and tipping	0	6½
Towage	0	2½
	1	8¼
Add interest and depreciation on cost of plant	0	2¼
Total cost per yard cube	1	10½

Similar work at Blyth cost 1s 2½d per yd cube and on the Suez Canal 1s 4d average exclusive of raising the rock by dredgers and carrying it away

Ordinary drilling blasting and dredging is more expensive—2s 2½d per yd cube more

Digging and throwing out in Trenches, including levelling Bottom and fixing and removing Shoring and close Planking where required not exceeding 6 ft deep—Trenches and tunnels are expensive to excavate on account of the confined space and labour in trimming sides In tunnelling for instance 2 yards cube may be a very good day's work The least width in which a navvy can dig comfortably with his whole body in the trench is about 2 ft 6 in Work in trenches thus costs 20 to 30 per cent more than digging over areas where the labour is not cramped The soil is merely deposited at a safe distance (of say 2 ft) from the edge of the trench from whence it is wheeled or carted away Take common ground A man would here be able to manage only 8 yards cube in one day as there is a limited space to work in and the soil has to be pitched out one throw A throw is taken to be 6 ft but sometimes 5 ft high and when a trench exceeds that depth stages must be provided Therefore—

	s	d
8 yards cube per day wages at 5s 7½d per day as before and $\frac{5s\ 7\frac{1}{2}d}{8}$ =	0	8½
Add for trimming sides fixing planking &c	0	1½
Add for profiles rods &c	0	2
	1	0
Add 20 per cent profit &c	0	2
Total price per yard cube	1	2

For made ground allow 12 yards per day 5 to 6 yards for clay or gravel 3 yards for chalk and 1 yard for hard rock requiring blasting

Extra for each additional 6 ft in Depth the first 6 ft being paid for under last Item—In shovelling materials it is usually reckoned that a man can throw the stuff horizontally 6 to 10 ft or upwards 4 to 6 ft so that if the depth of the

or navvy per cubic yard for each extra throw As before—

	s	d
5s 7½d wages per day / 20 yards cube per day =	0	2¾
Add for staging or planking where necessary	0	1
	0	4¼
Add 20 per cent profit &c	0	0¾
Total price per yard cube	0	5

For made ground allow 30 yards per day and for clay or gravel 15 yards

Spreading and Levelling in Layers not exceeding 12 in deep — A man can level from heaps without throwing 60 yards cube of common soil per day of nine hours so the price is simple—

	s	d
Wages 7½d per hour × 9 bours rate of 60 yards cube	60)5	7½
Rate of 1 yard cube	0	1¼
Add 20 per cent profit &c	0	0¼
Total price per yard cube	0	1½

Return fill in any Depth including Spreading Levelling, and well Ramming but exclusive of Wheeling or Carting — This is for filling in and ramming against sides of walls as they are being erected a portion of the earth already excavated which has been placed alongside the trenches in spoil heaps The cubical contents of cavity filled in is measured The work is merely labourer s and a man will fill in 20 yards cube per day a rammer attending on each filler Wages of each 7d per hour or 5s 3d a day and 5s 3d × 2 = 10s 6d Therefore—

	s	d
10s 6d wages per day / 20 yards cube per day =	0	6¼
Add 20 per cent profit &c	0	1¼
Total price per yard cube	0	7½

Forming Puddle walls filling to Coffer dams &c with Clay well worked and rammed in 6 in Layers —This is for thick masses the clay being worked about in layers with sufficient water to make it pasty and well cut cross cut and kneaded An excavator should temper spread and ram 1 yard cube in 6 hours Clay in London for puddling costs 5s 6d per yard cube but much less in the country The analysis would be —

	s	d
Clay clean yellow, for puddle, delivered in London	5	6
Water for working it up, say	0	1
Labour, 6 hours at 7½d	3	9
	9	4
Add 20 per cent profit, &c	1	10
Total price per yard cube	11	2

The cost of preparing 1 cub yd of puddle clay can be ascertained by using the following labours, the time for each operation being hours per man per yd cube —

Labour	Hours	
Excavating clay and filling into barrows	1½	per y. c.
Wheeling 25 yds, depositing and returning	½	„
Turning while in shallow heaps	1	„
	3	„
	3	„
	1	
empty	1	„

Digging for Post Holes under ¼ yard cube, including Filling in and Ramming—The following is from an actual case, where 7,112 holes were dug for planting young saplings, which would be equivalent to excavating similar ones for posts The holes were 1 ft × 1 ft × 1 ft, in common soil, and placed chequerwise 4 ft apart centre to centre, in adjacent plots A gang of about a dozen ordinary labourers were engaged, and for the 7,112 holes they took 2,868 hours digging only, 938 hours filling in, and 325 hours ramming Time occupied, eight weeks Wages 6½d per hour

An expert nurseryman came for 15 days to superintend the planting only, the holes having been dug ready for him before he arrived The detail therefore appeared—

	£	s	d
2,868 hours digging only, at 6½d	77	13	6
938 hours filling in at 6½d	25	8	1
325 hours ramming at 6½d	8	16	0½
	111	17	7½
Travelling expenses and return of foreman nurseryman	2	2	5
Lodging or hotel allowance of ditto 15 days at 10s per day	7	10	0
Pay of ditto 15 days at 10s 6d per day	7	17	6
	129	7	6½
Add 20 per cent profit, &c	25	17	6
	7,112)155	5	0½
Price per hole	0	0	5¼

The above price of 5¼d per hole is for an extremely large number at one time but for ordinary fewer numbers the rate would be 6d per hole, as shown under Prices for "Excavating

Removing

Barrow Runs —A barrow run is variously taken at 18 yds , ... Removing by wheel- ... War Department

Navvy Barrow

long Each foot of rise is considered equal to 6 ft or 9 ft on the level A large navvy's barrow holds $\frac{1}{10}$th of a cubic yard, and is run on 11 in $\times$ 3 in planks to avoid friction and to give spee...
steepest
but the ...
run two barrows can be kept going without waiting, and for the rate add 1*d* per yard cube per run, in addition to the

Dobbin Cart

by the man in attendance An ordinary builder's cart contains 1 yd cube A horse can draw 150 lbs. 2½ miles an hour for 8 hours, or say a load of 1½ cwt 20 miles per day The practical economical gradient for a horse and cart is 1 in 40

Rail Transport —Rail transport, or "leading" material as it is termed, is advisable for greater distances than the foregoing ½ mile if for large excavations It is performed in earth or tip wagons holding from 1½ to 3 yards cube, drawn on temporary rails by horses, locomotives or wire ropes worked by stationary

Iron Tip Wagon

engines An earth wagon holds as much as 20 or 30 wheelbarrows, and goes ⅕th faster, being equal, therefore, to 24 or 36 barrows For short distances under half a mile, and for small quantities, the carts would be employed, and tramways and perhaps light railways for more extensive removal For railway embankments and cuttings, locomotives are better than carting for distances over 1¼ miles When large excavations are over 20 ft deep, the material may be raised by vertical or inclined lifts, worked as single or double horse runs, or even as steam lifts, but for less depths such would not pay On temporary rails each foot of ascent is equivalent to 150 ft on the horizontal, but the practical economical gradient is 1 in 100 A higher up throw, an unfavourable lifting, a steeper gradient, an unnecessary moving of earth, adds to cost, good plant and tools, and well formed ways are essential A barrow carrying 2 ft cube without a plank run will carry 3 ft cube with one, a tip cart carrying 8 to 10 ft cube without, will carry 15 to 18 ft cube with, a good temporary way It is generally better to throw earth away than to lead it 3 miles

Wheeling or removing Stuff from Excavations, in Addition to the foregoing Items, not exceeding 50 yards, including filling the Barrows, &c, and depositing Stuff —This is for solid contents, measured before the ground is broken up, and called 'hole measured,' the amount of which is obtained in the Quantities by deducting the filling and ramming from the digging and throwing out Owing to the interstices, the increase in bulk of earth and clay when dug is one fourth,

way the spoil

"off the site,"

ted

A labourer can wheel and tip in a day 35 cubic yards of earth, one run distant and return, but for 50 yds (2 or 3 runs) only 17 cub yds, to save time, he will use two barrows the one which he wheels, and the other to be left behind for filling doring his absence Thus, one filler can attend on one wheeler In a long road, a platform or passing place is formed at the end of each respective run, and it is to each of these stages that the navvy wheels his loaded barrow, and returns to the preceding one with an empty barrow, where he shoold find another loaded one awaiting him Rankine says "The proportion of wheelers to shovellers may be est[illegible]

that a shoveller

with earth as a

100 ft on a horizontal plank, and return with an empty barrow"

	s	d
Wheeling per yard cube $= \frac{5s\ 3d \text{ wages per day (at 7}d\text{ per hour)}}{17 \text{ cubic yards per day}}$	$=0$	$3\frac{3}{4}$
Filling per yard cube $=$ ditto	$=0$	$3\frac{3}{4}$
	0	$7\frac{1}{2}$
Add 20 per cent profit &c	0	$1\frac{1}{2}$
Total price per yard cube	0	9

It is evident that the nature of the soil will affect the proportion of fillers and wheelers to each excavator For removing loose stuff 2 fillers and 2 wheelers will be required to each getter, who excavates quickly for compact earth 1 filler and 1 wheeler will be needed to each getter, whose [illegible]

[illegible]

going See Table in Memoranda

Add for Removing etc [illegible] 100 [illegible]
from Starting point —T[illegible]
under last item, this is [illegible]
under the same, as th[illegible]
instead of 50 yards

	s	d
Half the cost of wheeling as before $3\frac{3}{4}d \div 2$	0	$1\frac{7}{8}$
Add 20 per cent profit &c	0	$0\frac{1}{4}$
Total price per yard cube	0	2

A common price is $1d$ per yard cube per run for removing [illegible]

[illegible] 1 *furlong, and* [illegible] yards, horse [illegible] labour being a very expensive item For a horse and cart the practical economical gradient is 1 in 40 A man will fill into a cart the same amount of earth he will pitch out of a trench at one throw—viz, 20 yards cube in one day The rate for cartage, horse, cart, and driver, is $12s\ 6d$ per day, and 21 yards cube can be removed 1 furlong, deposited, and returned in that time including detention The driver should also help to fill the cart

	s	d
Filling carts $= \frac{5s\ 3d \text{ labourer's wages per day}}{20 \text{ yards cube per day}} =$	0	3
Carting depositing and returning $= \frac{12s\ 6d \text{ cartage per day}}{21 \text{ yards cube per day}} =$	0	7
	0	10
Add 20 per cent profit &c	0	2
Total price per yard cube	1	0

. . . for under last head . . . times as quick—that . . . alf the cartage at 7*d* . . . ds and not exceeding 1 furlong about *half* a furlong) or, say, 1*d* per yard cube or load including profit When the distance is over ¼ mile, it will be more economical to use wagons on rails A horse cart and driver can go 1 mile and return 1 mile, occupying 1¼ hours to obtain a load of gravel Contractors . . .

hills is 1¼ tons on a very level road a good horse will draw 2 tons Horses are costly, a motor lorry is 25 per cent cheaper

In hilly districts the load must be light, in which case arrange with local carters for the price at per ton and not at per load

Basketing Earth or Rubbish of any kind as from the Interior to the Outside of a Building any Floor—Removing earth or rubbish in baskets is only resorted to where a barrow cannot be managed as in carrying stuff up or down steps A basket holds a bushel or $\frac{1}{27}$ of a cubic yard It therefore contains half as much as a barrow and the labour of carriage would thus be twice as great, involving as it does double the number of journeys Removing distance 25 yds The cost of filling would be practically the same as for wheelbarrows with perhaps a slight increase of labour

	s	*d*
Conveyance of baskets twice cost of wheeling 25 yds at 1¾*d*	0	3½
Filling ditto same as filling barrows but with slight increase	0	4
	0	7½
Add 20 per cent profit &c	0	1½
Total price per yard cube	*0*	*9*

Carting Rubbish and finding a Shoot not exceeding one Mile—In London rubbish is carted away and a shoot found for 3*s* 6*d* per load reduced to 2*s* 6*d* in the suburbs Every additional mile is reckoned at 1*s* Cartage will cost more in a large city on account of the congested traffic also in a hilly neighbourhood because of the greater labour

pulling and consequently fewer loads pulled. A rough engineering axiom is "a shilling a load a mile." A horse, cart, and driver cost 12*s*. 6*d*. per day, which implies 3 to 12 loads per day, according to the variable conditions above mentioned. On a return journey the valuation of the load is frequently assumed to be only half the price of the original delivery.

Cartage of Bricks, Stone and Timber.—The cartage &c. of bricks costs 5*s*. per thousand for the first mile, and 1*s*. ditto for each mile beyond. Stone merchants charge 5*s*. per load of 1¼ tons for cartage within four miles, about 2½*d*. per foot cube. Deals are carted from the London docks to the City at 10*s*. per Petersburg standard, or say ¾*d*. per foot cube. Balk timber is similarly conveyed for 4*s*. per load of 50 cubic feet, rather less than 1*d*. per foot cube.

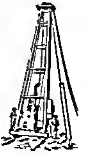
TURFING

Cutting or taking up Grass Sods any reasonable size and Rolling and Stacking for use.—Three men will cut 100 sods per hour, size being about 24 in. × 12 in. × 3 in. = 200 ft. super. Therefore take half of this for price of 100 ft. super.

	s.	*d.*
3 excavators cutting 3 hours at 7½*d.*	1	10½
Add for rolling and stacking	0	4½
	2	3
Add 20 per cent. profit, &c.	0	5
Price of 200 ft. super	2)2	8
Price of 100 ft. super	1	4

PILING

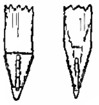
Fir Piles including Heading, Pointing and driving complete.—The cost of piles and driving varies considerably, but under favourable circumstances the statement after may be taken as approximately the analysis of the price of a 12 in. × 12 in. pile 40 ft. long driven 30 ft. into the ground. It is based on a contribution to the Institution of Junior Engineers in April 1899 by Mr. H. C. Reid, M.I.C.E., Admiralty Works Dept., but slightly amended by the author.



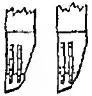
Steam Pile-Driver

	£	s	d
40 ft. cube fir or pitch pine at 2s.	4	0	0
1 cast iron shoe and straps	0	3	0
Use of ring per pile	0	0	6
Labour in ringing and shoeing	0	4	0
Pitching pile, including one move of pile engine	0	2	6
30 ft. run driving in medium soil at 10d.	1	5	0
Cutting off head on shore	0	1	0
	5	16	0
Add 20 per cent. profit, &c.	1	4	0
Total per pile	40)7	0	0
Price per foot cube	0	3	6

Electric pile drivers are now used, as well as steam. For reinforced concrete piles, *see Concrete*.



Shoes of Square Piles.



Shoes of Sheet Piles.

CHAPTER VI.—CONCRETOR.

MEMORANDA.

Measures

A striked imperial bushel = 1 2837 ft cub
" " " = $1\frac{1}{4}$ f c approx
" " " $\frac{1}{21}$ y c (0475)
" " " = 4 pecks
" " " = 8 gals
" " " = a box 13 in × 13 in × $13\frac{1}{8}$ in internal
A heaped imperial bushel = 1 625 ft cub
A striked Winchester bushel = 1 244 ft cub
A cubic foot = 779 striked imperial bushel
" " = 804 striked Winchester bushel
A cubic yard = 21 striked imperial bushels of sand, earth, &c
(21 × 1 2837 f c 27 f c nearly)
" " = 17 heaped imperial bushels of sand earth &c
(17 × 1 625 f c = $27\frac{1}{2}$ f c about)
" " = $21\frac{7}{10}$ striked Winchester bushels
(21 704 × 1 244 f c = 27 f c)
A navvy's barrow, large = $\frac{1}{10}$ yd cub capacity
" " " $2\frac{7}{10}$ ft cub capacity
" " " = $2\frac{1}{4}$ f c average load
An iron wheel barrow = $3\frac{1}{4}$ f c sand, large load
" " " 3 f c aggregate, large load
" " " = 2 f c concrete large load

Gauge Boxes for Concrete

1 yd cube = 4 ft 6 in × 3 ft 0 in × 2 ft 0 in 27 ft cube
$\frac{1}{2}$ " = 3 ft 0 in × 3 ft 0 in × 1 ft 6 in = $13\frac{1}{2}$ "
$\frac{1}{4}$ " 2 ft 6 in × 2 ft 6 in × 1 ft 1 in = $6\frac{3}{4}$ "

Portland Cement

Ordinary Measure

1 striked imperial bushel	112 lbs.
2 " "	= 1 bag
1 bag or sack net	= 2 bushels
1 " " "	= 2 cwt
1 " "	= $2\frac{1}{4}$ f c approx
1 ft cube, loosely filled	= 87 lbs
26 " " "	= 1 ton
1 yd cube " "	= 2 350 lbs
10 bags × 2 bushels of 112 lbs each 2 240 lbs	= 1 ton
1 load, say 1 y c , about	= 1 ton
1 " " "	= 10 bags
1 " " "	= 20 bushels

TRADE CUSTOM

1 cental or trade bushel	= 100 lb
2	= 1 bag
1 bag or sack net	= 2 centals
1	= 200 lbs
1	= 2¼ f c approx
1 ft cube loosely filled	= 87 lbs
26	= 1 ton
1 yd cube	= 2 350 lbs
11 bags × 2 centals of 100 lbs each = 2 200 lbs	= 1 ton approx
11¾ bags 2 350 lbs	= 1 yd cube
1 empty bag size	= 39 in × 22 in
1 weight when new	2 to [illegible] lbs
1 weight after use	= 2¼ to 3¼ lbs
11 (which contained 1 ton)	= 1 bundle
1	= 33 lbs
1	= 4¼ f c approx
1	= 26 lbs
1	400 lbs
6 net or cement only	= 1 ton
5 or 1 load (casks + cement = 2 130 lbs)	1 ton approx
1 small fir cask holds 2 centals net	= 200 lbs
1 weighs when empty	= 19 lbs.

BRITISH STANDARD SPECIFICATION FOR PORTLAND CEMENT

Fineness	Residue min 3 % on sieve 76 × 76 = 5 776 meshes per sq in 18 % on sieve 180 × 180 = 3[illegible] 400 meshes per sq in
Specific Gravity	Not less than 3 15 when freshly made or 3 10 if ground 4 weeks
Tensile Strength	Neat Cement min after 7 days per sq in 400 lbs 28 days per sq in 500 lbs 1 cement 3 sand min after 7 days per sq in 150 lbs 28 days per sq in 250 lbs
Standard Sand	To pass sieve from 20 × 20 = 400 meshes per sq in to 30 × 30 = 900 meshes per sq in Wire 0164 in and 0108 in diameter
Soundness	Expansion on Le Chatelier test not to exceed— 10 millimetres after 24 hours aeration 5 7 days
Setting Time	Quick —Final setting time 10 to 30 minutes Medium —Final setting time ½ to 2 hours Slow —Final setting time 2 to 7 hours

Portland Cement also—

Becomes hard in	24 hours
Sets strong in	7 days
Great strength in	1 year
Maximum strength in	3 years

Tensile Strength of Portland Cement

(In lbs per sq in)

Age.	Neat Cement.	1 Cement to 1 Sand	1 Cement to 2 Sand	1 Cement to 3 Sand	1 Cement to 4 Sand	1 Cement to 5 Sand
	lbs	lbs	lbs	lbs	lbs	lbs
1 day (24 hours)	340	230	150	100	70	60
3	500	320	250	200	150	130
7	650	400	330	250	210	180
	*400			*150		
14	700	450	380	300	250	210
21	720	500	410	320	280	240
28	750	550	450	350	300	270
	*500			*250		
1 month	760	560	460	360	310	280
3	800	600	520	4[illegible]0	350	300
6	870	650	580	460	380	330
9	950	700	620	510	410	350
1 year	1 000	750	650	550	440	3[illegible]0
2	1 070	800	700	600	480	400
3	1 150	850	750	[illegible]	5[illegible]0	440

*Denotes British Standard Specification allowance which is low

Decreasing Strength with Sand

Cement mortar decreases in strength as the proportion of sand is increased as follows at the end of one year —

1 cement and	1 sand has about	3/4 strength of neat cement
1	2	2/3
1	3	1/2
1	4	[illegible]
1	5	1/3

Compressive Strength of Portland Cement

(Resistance to crushing in lbs per sq in)

Age	Neat Cement.	1 Cement to 1 Sand	1 Cement to 2 Sand	1 Cement to 3 Sand	1 Cement to 4 Sand	1 Cement to 5 Sand
	lbs	lbs.	lbs	lbs	lbs.	lbs
1 day (24 hrs)	1 500	800	500	400	300	200
3	5 600	4 000	2 200	1 700	1 100	800
7	7 500	5 600	4 000	3 500	2 200	1 500
14	8 000	6 000	4 200	3 900	2 600	1 600
21	8 100	6 300	5 700	4 300	2 800	1 900
28	8 500	6 500	5 800	4 400	2 900	2 000

Water

1 gal. of water	= 0·16 f.c.	1 ton of water	= 36 ft. cub.
1 "	= 10 lbs.	1 "	= 1⅓ yd. cub.
1 ft. cub. of water	= 62½ lbs.	1 "	= [illegible] gals.
1 "	= 6¼ gals.	1 butt	= 108 gals.
1 yd. cub.	= 15 cwt.	1 bushel	= 8 gals.
1 "	= 169 gals.	1 "	= 80 lbs.

Water for Concrete

Water for mixing neat P. cement = 15 to 2[illegible] % by weight of cement
= 18 to 20 % by volume of cement

Water for ordinary cement concrete = ¾ to 1 gal. per ft. cube
= 20 to [illegible]7 gals. per yd. cube
25 gals. per y.c. average

Concreting Materials

Description	Weight per ft. cube	Weight per bushel	Weight per yd. cube	Ft. cube per Ton	Bushels per Ton
Matrices	lbs.	lbs.	cwt.	f.c.	bush.
Stone lime in lump (from kiln)	55	[illegible]0½	13	41	31
Grey chalk lime ditto ditto	44	56½	10	51	40
Blue lias or hydraulic lime ditto	60	[illegible]	14½	37	29
Blue lias or hydraulic lime ground (fresh)	54	69	13	41½	3[illegible]½
Portland cement	87	112	21	26	[illegible]0
Fine sand, river or pit, dry	95	1[illegible]2	23	[illegible]3½	18
wet	110	141	26½	20	16
Coarse sand, river or pit, dry	100	129	24	22	1[illegible]½
wet	120	154	29	19	14½
Water, fresh	62½	80	15	36	28
Aggregates					
Brick stock broken to 2 in.	[illegible]7	73	13¾	39	31
Portland stone broken to 2 in.	85	109	20¼	26	21
Ragstone broken to 2 in. cube	100	129	24	[illegible]2	1[illegible]½
Whinstone broken to 2 in.	103	132	24¾	22	17
Granite broken to 2 in.	103	132	24[illegible]	2[illegible]	17
Granite siftings for surface	90	115½	21½	25	19
Gravel	116	149	28	19	15
Shingle	100	128	[illegible]4	22	17½
Thames or river ballast	112	144	27	20	15½
Burnt clay ballast	72	92	17	31	24
Clinker	50	64	12	45	35
Cinders, clean	60	77	14½	37	29
Coke, ordinary	46	59	11	49	38
Coke breeze	37	47½	9	60½	47

Note.—The bushel above is taken as a stricked imperial bushel 1·[illegible]83 f.c.

Granite Siftings

1 ton siftings with 1 ton cement (1 to 1) will cover —

$\frac{1}{2}$ in thick	44 yds sup
$\frac{3}{4}$ in	32
1 in	24
$1\frac{1}{2}$ in	18
2 in	15

A common proportion is 1 cement to 2 siftings 1 in thick on all concrete surfaces subject to wear such as pavings ground floors &c

Burnt Ballast

2 cwt small coal will burn 1 cub yd of clay
1 ton 12
1 chaldron breeze will burn 9 to 12 cub yd of clay

Breaking Aggregate

A labourer can break to 2 in cube per day (measured after breaking) —

Brick hard core &c	$3\frac{1}{2}$ to	4 yds cube
Flint field stones	3	4
Limestone sandstone	2	$2\frac{1}{2}$
Basalt igneous rock	1	$1\frac{1}{2}$
Granite syenite	$\frac{1}{2}$	1
By machinery various stones and sizes	60	90

Labour making Concrete

y c

per day

Machines mix concrete at least 20 times against 4 or 6 by hand

Proportions for Concrete

Class of Work	Gauge	Proportion (by volume).				Thickness
	Inches	Cement	Sand	Aggregate	Proportion	Inches
Ordinary Concrete						
Tanks reservoirs and thin partitions	$\frac{1}{2}$ to [illegible]	1	$1\frac{1}{2}$	3	1 to 3	3 to 12
Arches cast blocks for caps copings lintels, heads mouldings quoins sills steps surface channels curbs &c	$\frac{1}{2}$ to $\frac{3}{4}$	1	2	3	1 to 3	6 to 18
Upper floors hearths verandahs flat roofs and stable paving &c	$\frac{1}{2}$ to $\frac{3}{4}$	1	–	4 –	1 to 4	6 to 7

PROPORTIONS FOR CONCRETE—*continued*

Class of Work	Gauge	Proportions (by volume).				Thickness
	Inches	Cement	Sand	Aggregate	Proportion	Inches
Walls under 1 ft thick with loads	¾ to 1	1	2	4	1 to 4	4 to 12
Ground floors hearths verandahs footpaths bases concrete layers under wooden and block floors and tiles &c	¾ to 1	1	2	5	= 1 to 5	4 to 6
Walls 1 to 2 ft thick with loads	1 to 1½	1	2	5	= 1 to 5	12 to 24
Walls 2 to 4 ft thick with loads	1½ to 2	1	2	6	= 1 to 6	24 to 48
Foundations to loaded walls of buildings	1 to 1½	1	2	6	= 1 to 6	12 to 24
Foundations to unloaded boundary walls	1 to 2	1	3	7	= 1 to 7	12 to 24
Mass concrete in large works	2 to 2½	1	3	8	= 1 to 8	24 to 72
REINFORCED CONCRETE						
Pipes culverts drains &c	¼ to ⅜	1	1	2	1 to 2	1 to 4
Baths tanks reservoirs &c watertight to resist liquid pressures and sea piles	¼ to ½	1	1½	3	= 1 to 3	3 to 6
Floors roofs slabs walls partitions &c up to 4 in thick	¼ to ½	1	1½	3	= 1 to 3	2 to 4
Floors roofs slabs walls pavings &c over 4 in thick and arches beams piers columns piles &c	½ to ¾	1	2	4	= 1 to 4	4 to 18
Foundations retaining walls abutments &c	½ to ¾	1	2	5	= 1 to 5	6 to 24

Fire resisting concrete should have fine cement and small aggregate. Coke breeze burnt clay ballast clinker and broken brick are good, but Thames ballast gravel shingle and stones are bad.

SHRINKAGE AND COMPRESSION

Cement when wetted shrinks	$\frac{1}{10}$ or 10 %
Sand	$\frac{1}{5}$ 20 %
Lime and sand when mixed and wetted shrink	$\frac{1}{4}$ 25 %
Cement and sand " "	$\frac{1}{6}$ 17 %
Compression of concrete after mixing watering and ramming in position of the dry mixture	$\frac{1}{10}$ to $\frac{1}{3}$
ditto in ordinary work average	$\frac{1}{5}$ or 20 %

Compression ditto of breeze concrete	$\frac{1}{3}$ or 33 %
Ditto ditto by ramming alone	$\frac{1}{10}$ 10 %
Beating and ramming increase weight by	$\frac{1}{20}$, 5 %
strength by	$\frac{1}{4}$, 25 %

Ordering Cement

For 1 1½ 3 concrete allow	3 sacks, or	1½ casks per yd cube		
1 2 4	2½	1¼		
1 2 5	2¼	1⅛		"
1 2 6	2 "	1		
1 2 7	1¾	⅞		
1 2 8	1½	¾		

A sack = 200 lbs and a cask = 400 lbs net Add 20 % for waste &c

Breeze Concrete

8 f c (6 bushels) Portland cement and 29 f c coke breeze ¾ in gauge with ⅓ to ½ coarse sand = 1 yd cube breeze concrete 1 to 3

Weight of Concrete

	lbs
Lime concrete various aggregates	120 to 130 per f c
Cement concrete coke breeze aggregate averages	80
clinker	100
slag	120 "
brick	120
ballast	140
stone	140
gravel	145
granite	150 "
reinforced	150
Neat Portland cement when set averages	125
1 cement and 1 sand	120
1 2	115
1 3	110

Strength of Concrete

	Crushes at	Safe Load
Grey lime concrete 1 to 6	15 tons per f s	2 to 3 tons per f s
Lias	20	3 to 4
1 cement	180	20 to 30

At 1 month old concrete has about	60 per cent of full strength
3	66
6	75
1 year	90
2	95
3	100

Setting and Building

Before building on cement concrete foundations allow	7 days minimum
Before removing casing of cement concrete walls	14
Before striking centering of cement concrete roofs	21
floors	28

Rule —Allow 2 days per foot of span Thus an *arch* or *floor* of 12 ft span would require 24 days before removal of centering minimum

Waterproofing Concrete

1 Plaster surface with 1 cement and 2 sand while concrete is green

Colouring of Concrete and Cement Rendering

(The Everyday Uses of Portland Cement)

Colouring Materials	Red	Yellow	Blue	Green	Chocolate	Black	White	Pink
	vols	vols	vols	vols	vols	vols	vols	vols
Portland cement very fine	87	84	80	85	88	87	67	84
Black oxide of iron or copper	2	2	2	3	2	—	—	—
Red oxide of iron	11	—	—	—	4	—	—	—
Yellow oxide of iron	—	14	—	—	—	—	—	—
Azure blue or ultramarine		—	18	—	—	—	—	—
Oxide of chromium	—	—	—	12	—	—	—	—
Black oxide of manganese	—	—	—	—	6	13	—	—
Powdered chalk or barium sulphate	—	—	—	—	—		33	—
Barium sulphate (common barytes)	—	—	—	—	—	—	—	15
Crimson lake (alumina base)	—	—	—	—	—	—	—	1
Total parts by volume	100	100	100	100	100	100	100	100

Reinforced Concrete

General Principles

(*a*) Concrete arranged to take compression and steel tension

(*b*) Distribution of reinforcement according to the strain

Concrete

The concrete must be a wet or sloppy mixture with small sized aggregate for close packing and affinity laid in small batches and well rammed in 3 in layers Mix by machinery if possible and sea water disallowed

Avoid excess of sand as it is the proportion of cement to sand (i e mortar) which governs the strength of concrete and not the proportion of cement to total aggregate Lowest 1 cement to 2 sand Sand of medium grain

Good clean materials and skilled workmanship necessary Crushed slag clinker and coke breeze not recommended as they chemically affect the steel. Maximum gauge ¾ in and minimum ¼ in under which is reckoned as sand but size varied as much as possible within the limits allowed which are —

Aggregate limits	¾ in to ¼ in mesh
Sand limits	1/16 in to ¼ in
	75 % to pass ⅛ in
Proportions of concrete	1 1 2 1 1½ 3 1 2 4 1 2 5
Weight of cement taken as	90 lbs per f c
Weight of reinforced concrete	140 to 160

CONCRETE—*continued*

Proportions of concrete	Ultimate crushing resistance of plain concrete after— 28 days	90 days	Working compression on plain concrete after— 90 days
1 2 4	1 800 lbs per sq in	2 400 lbs per sq in	600 lbs per sq in
1 1½ 3	2 100 lbs	2 800 lbs.	700 lbs
1 1 2	2 700 lbs	3 600 lbs	900 lbs

	lbs
Concrete in beams safe bending compression	600 per sq in
columns safe simple compression	600
beams safe shear	60
Adhesion or grip of concrete to steel safe	100
Tension resistance $\frac{1}{10}$ compression resistance (but neglect resistance to tension as small)	60
Co efficient of elasticity of concrete	2 000 000
steel	30 000 000
Maximum elongation of ordinary concrete without cracking	1 in 10 000
reinforced	1 in 1 000
Co efficient of expansion of concrete per deg Fah	0000060
steel	0000067

(these two expansions are practically equal which is important)

Neat cement when setting in water swells 001 to 002 per unit of length

air shrinks 0015 to 002 per unit of length

Cement concrete when setting in water swells ·0002 to 0005 per unit of length

air shrinks ·0003 to 0005 per unit of length

STRIKING OF CENTRES

	days
Casing of columns beams and floor slabs under 4 ft span	8 minimum
over	14
Centering of large span arches	28

Loading tests on the structure itself should not be made until concrete laid at least 2 months Test load should not exceed 1½ accidental or superimposed load

SAFE LOADS ON FLOORS

Dwellings offices &c	1 cwt per ft
Public buildings	2
Warehouses factories &	3

STEEL.

Mild steel being soft and ductile is best as hard or high carbon steel is too brittle Welding forbidden The metal should be perfectly clean and free from scale or loose rust not oiled galvanised painted or tarred but a wash of thick Portland cement grout is desirable

For fire protection armature to be covered with concrete of a minimum thickness of ¾ in for floor slabs and 1 in for beams and pillars

STEEL—*continued*

	Ultimate	Safe	
Tensile strength of steel not less than	lbs 60 000 per sq in	lbs 16 000 per sq in	
Elastic limit or yield point 50 to 60 % of last	32 000	8 000	,,
Compressive strength of steel	60 000	16 000	
Steel in compression — 15 times stress in the surrounding concrete			
Shear resistance of steel	50 000	12 000	
Elongation of bars under 1 in diam on a gauge length of 8 diameters			22 %
Elongation of bars over 1 in diam on a gauge length of 4 diameters			27 %
Contraction of area at point of fracture at least			45 %
Must stand bending cold angle to diameter of thickness of pieces tested			180°

PROPORTION OF REINFORCEMENT

Reinforcement varies from ½ to 5 % sectional area of the steel compared with the sectional area of the concrete as follows —

For arches allow	1	to 2 per cent reinforcement
beams	2	3
columns	1	2
piles	2½	5
pipes	½	1
slabs	½	1½
walls	1	2

Sizes of reinforcing bars round square or flat ¼ to 2 in
1 per cent weight of steel = 132 lbs per yd cube of concrete
Weight of steel = 490 lbs per ft cube

ECONOMY IN CONSTRUCTION

General economy for large structures	20 to 30 per cent
In heavy foundations	30 40
In large factory chimneys	30 40
In stanchions saving over steel	15 20
In beams saving over steel	15 25

SYSTEMS

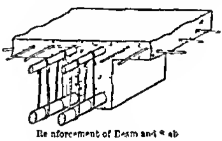
1 Coignet
2 Considère
3 Cottancin
4 Expanded Metal
5 Hennebique
6 Indented Steel Bar
7 Kahn
8 Lock Woven Mesh
9 Monier
10 Ransome

And many others

SYSTEMS OF REINFORCED CONCRETE

THE COIGNET SYSTEM

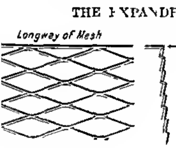
Alternate Reinforcement Bar



Reinforcement of Beam and Slab

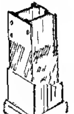
Reinforced Pillar

THE EXPANDED METAL SYSTEM



Form of Reinforcement

[illegible]

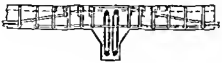


Riveted [illegible]

[illegible]

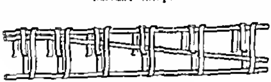
SYSTEMS OF REINFORCED CONCRETE.

THE "HENNEBIQUE" SYSTEM



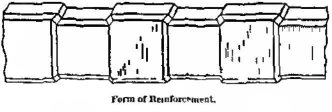
Beam

Bars and Stirrups

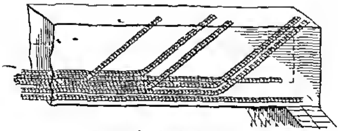


Complete Reinforcement

THE "INDENTED STEEL BAR" SYSTEM



Form of Reinforcement.



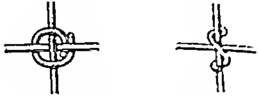
Beam reinforced with Indented Bars (Note the Shear Members)

SYSTEMS OF REINFORCED CONCRETE

THE "KAHN" SYSTEM

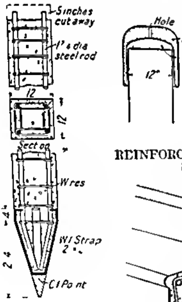
Form of Reinforcement.

THE LOCK WOVEN MESH SYSTEM

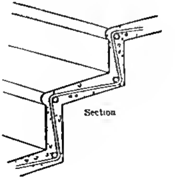


Lock Knot. Spiral Knot

REINFORCED CONCRETE PILE



REINFORCED CONCRETE STAIR



Section

PRICES

Concrete, 1 to 6, for Foundations

The following prices include mixing, wheeling, hoisting or lowering not exceeding **30 ft**, depositing up to 25 yds, ramming, and profit. Add **1s** per yard cube for hoisting every additional **10 ft**, and **6d** for lowering ditto.

Description	Grey or [illegible] Lime		Hydraulic or Blue Lias Lime		Roman or Medina Cement		Portland Cement	
	s	*d*	*s*	*d*	*s*	*d*	*s*	*d*
Concrete 1 to 6, in foundations for walls composed of screened Thames ballast, or pit gravel, [illegible]	13	9	14	2	15	0	16	6
D[illegible]	14	10	15	6	16	6	17	6
Ditto composed of broken rag or similar stone, 1 to 2 in cube, with sand per yd cube	20	0	22	0	21	0	25	0
Add to foregoing if spread over surfaces in thicknesses of 1 ft and under per yd cube	1	0	1	0	1	0	1	0
Add if above foundations in retain in walls, underpinning, &c per yd cube	1	6	1	6	1	6	1	6
Add if in small blocks, including moulds, and setting in cement per yd cube	—		—		7	6	8	6
Add if executed between high and low water mark, including protection against the tides per yd cube	—		—		3	0	3	0
Forming chamfer or nosing under 4 in girth straight per ft run	0	2	0	2	0	3	0	3
Ditto ditto curved	0	3	0	3	0	4½	0	4½
Forming rebate or groove, under 6 in girth straight per ft run	0	3	0	3	0	4	0	4
Ditto, ditto curved „	0	5	0	5	0	6	0	6

Concrete for Paving, Floors and Roofs

The following prices include mixing, wheeling, hoisting or lowering not exceeding **10 ft**, depositing, ramming, and

profit Add ½d per yard super per inch in thickness for hoisting every additional 10 ft, and ½d for lowering do

Description				
	s	d	s	d
Concrete bed 1 to 5 under boarded floors tile paving &c composed of clean porous material such as hard burnt bricks &c ¾ in cube with a proper proportion of fine stuff, 4 in thick per yd sup	2	0	2	[illegible]
Ditto ditto 6 in thick	2	9	3	6
Ditto ditto 9 in	4	0	5	0
Ditto ditto 12 in	5	3	6	6
Concrete 1 to 4 in upper floors roofs &c ¾ in cube composed as above laid and floated 4 in [illegible] per yd sup	—		[illegible]	0
[illegible]			4	3
[illegible]	—		6	0
[illegible]			7	[illegible]
[illegible] sup			0	8
coat of lime putty per yd sup			0	5
Ditto if soffit is rendered with a thin coat of 1 cement and 1 sand per yd sup	—		1	3
Floating surfaces of concrete and bringing to a fair face ¾ in thick per yd sup	—		1	1
Spike rolling surfaces of new concrete paving			0	2
Concrete for fireproof floors 1 cement 3 coke breeze 2 broken brick ¾ in cube 1 coarse sand filled in between iron joists levelled and rammed				
[illegible]	—		1	9
[illegible]	—		2	6
[illegible]			0	6
[illegible]			0	1
Forming channels in concrete not exceeding 9 in [illegible] run	—		0	[illegible]
[illegible] each	—		1	[illegible]
[illegible]	—		1	6
[illegible] lintels, steps quoins copings pier caps &c and set in cement including moulds and hoisting up to 30 ft per ft cub	—		2	0

		s	d
Dry filling of broken brick 2 in cube under concrete floors supplied only	per yd cube	5	6
Ditto but spread levelled and rammed 4 in thick,	per yd sup	0	9
Ditto ditto ditto 6 in thick	"	1	1

Asphalte over Concrete Roofs

	s	d
$\frac{3}{4}$ in Val de Travers asphalte for roofs in two thicknesses [illegible]	6	6
[illegible]	7	6
[illegible]	8	6
[illegible]	9	6
[illegible]	0	10

Reinforced Concrete

General proportions 1 cement 2 sand and 4 aggregate, $\frac{1}{4}$ to $\frac{3}{4}$ in gauge See Memoranda for details Concrete to be deposited in layers not exceeding 3 in thick, and in quantities not more than $\frac{1}{4}$ ft cube closely punned around the steel with metal rammers Layers to follow rapidly to prevent partial setting or distinct joints between them Prices include hoisting up to 50 ft and keeping the steel rods in position while concrete is being laid but the concrete, the centering and the steelwork are taken separately to start with

Concrete

		s	d
1 2 5 in foundations over 6 in thick	per y c	23	0
1 2 4 in floors roofs slabs partitions &c 4 to 12 in thick		21	0
1 $1\frac{1}{2}$ 3 in floors, roofs slabs partitions &c under 4 in thick		25	0
Forming and well trowelling surface true and even	per y s.	0	6
Making good underside after removal of centering stopping air holes and defects and rendering with a thin coat of lime putty or cement and sand		0	10
1 2 4 in walls pavings arches beams piers columns posts [illegible]			
[illegible]	per f c	2	6
[illegible]		1	3

First and subsequent use of centering for concrete floors roofs &c, including all strutting fixing, casing and removal rough flat	per y s	1	6
Ditto ditto ditto ditto curved		2	0
Ditto d [illegible]		1	4
Ditto d [illegible]		1	10
Ditto [illegible]	per f s	0	4
Ditto d [illegible]		0	6
Add if centering or casing is wrot o s, and flush at joints	per y s	0	5
Moulds for forming rounded angles, rebates reveals &c under 9 in girth	per f r	0	2

Steel

Ditto, in expanded metal and wire systems, and [illegible]
Cutting steel bars to rake or curve, including [illegible] notches, and waste [illegible]

Complete Work

The following may give a very general [illegible] whole work, combining concrete, centering, and [illegible] forcement, complete, but there are so many [illegible] is impossible to be more definite, and the [illegible] must be great —

Reinforced concrete floors, 3 to 6 in thick, [illegible]

Ditto ditto steps and sills, av 12 in × 6 in [illegible]

Materials

(WITHOUT PROFIT)

		s	d
Ballast, burnt clay	per yd cube	[illegible]	[illegible]
Ballast, Thames	"	[illegible]	[illegible]
Cement, Portland, including use of bags	per bushel	1	[illegible]
Ditto, per bag weighing 2 cwt, and containing 2 bushels	each	[illegible]	[illegible]
	"	[illegible]	[illegible]
	per ton	[illegible]	[illegible]
	per bushel	1	[illegible]
	per yd cube	[illegible]	[illegible]
	"	[illegible]	[illegible]
n or	"	1[illegible]	[illegible]
required	"	[illegible]	[illegible]
	"	6	[illegible]
ground fine, grey	per bushel	0	[illegible]
	[illegible] 8 sacks or 16 bushels	12	0
ground fine blue [illegible]	per bushel	0	10
Ditto ditto	per yd cube	17	0
Ditto ditto	per ton of 32 bushels	25	0
Lime, including use of bags unslaked, ground fine, white chalk	per bushel	0	7½
	per yd cube	4	6
	"	11	0
		10	0
	"	9	0
Breaking old bricks into 2 in or 3 in cubes for concrete, filling, &c, hand labour only	per yd cube	1	6

		s	d
Breaking ragstone into 2-in cubes	hand labour only per yd cube	2	8
	machine labour only	1	0
Sand pit or river clean sharp	unwashed	[illegible]	0
"	hand washed	13	6
	washing labour only	1	9
	screening	0	[illegible]
sea washed and dried		[illegible]	0
Water clean fresh including delivery under one mile	per ton of 224 gals	3	6
Water supplied by Metropolitan Water Board	per y c of concrete	0	1½

Wages

		s	d
Wages excavator	per hour	0	7½
labourer		0	[illegible]
ganger		0	8½

ANALYSIS

Materials

Burnt Ballast—The term ballast is derived from the use of similar materials placed in the hold of a ship to keep it steady when there is no cargo It is much employed in the shape of broken stone gravel &c for making concrete and forming roads as well as on railways When ready made ballast is not procurable burnt clay ballast is used [illegible] That [illegible] r small [illegible] n with lumps of clay or brick earth more fuel is scattered over this then more clay 6 in thick and so on in alternate layers It may be cooking so to speak for weeks In this way as much ballast can be made as will be wanted It is most important that the clay should be thoroughly burnt otherwise it will return to its natural condition Burnt ballast by itself how [illegible]

such as broken bricks stone or gravel it is all right The clinker refuse from the Newington dust destructors at Meopham is much more suitable and its greater cost would be more than repaid with the better results obtained.

It takes about 2 cwt of fuel to burn 1 cubic yard of clay or 1 ton will burn 12 yards and calculating small coal at 16s per ton the cost of production would be —

	s	d
1 cubic yard of clay in the field	1	6
Excavating ditto and spreading	0	11
Labour in burning	0	6
2 cwt coal at 16s per ton	1	7
Total price per yard cube	4	6

Sometimes only 1 cwt of coal is allowed per yard cube of clay, which seems inadequate

A chaldron of breeze at 9s burns from 9 to 12 cubic yards of clay Proper clay can sometimes be obtained from the building site, in which case its price would be eliminated

Thames Ballast —This is a natural mixture of gravel or shingle with sand, in the proportion of two of the former to one of sand, that from above the bridges is the cleanest It is sometimes specified 'above bridge (London Bridge) Therefore no sand need be added when this is used for concrete Thames ballast costs 5s to 6s per yard cube delivered

Breeze —So called "breeze' is coke from which less gas has been extracted than from ordinary coke, and should be washed three times to remove all dust and earthy substance Coke breeze can be obtained from any gasworks, and should pass a ½ in mesh A coke chaldron of the London district is a measure containing 36 striked imperial bushels Breeze is light and therefore much used for concrete on upper floors It weighs 9 cwt per yard cube, or 37 lbs per ft cube Price, 3s 6d per yard cube, or 8s per ton

Portland Cement —This is an artificial combination of chalk and clay, in the proportion of about 75 per cent chalk to 25 per cent clay, and is so named from a supposed resemblance in its colour to Portland stone The heaviest qualities set the slowest, but are the best as they ultimately attain the greatest strength The usual weight specified is 112 lbs or 1 cwt per striked bushel

By ordinary measure each sack or bag contains 2 bushels, weighing 2 cwt, which gives 10 sacks to the ton But by London custom the bags contain 2 centals, or trade bushels, of 100 lbs each, giving 200 lbs, net of cement per sack, and the manufacturers quote, not for a ton of 2,240 lbs, but for a "ton of 11 sacks *i e* 2,200 lbs only

The bags themselves weigh 2 to 2½ lbs each, and should not be included in the weight of the cement Those of No 1 canvas cost 20s per dozen, and those of jute, 10s per dozen, when new When the cement merchants supply them each bag is charged 1s 2d, of which 1s is refunded to the builder if he *returns the bags within one month and* pays carriage, the difference of 2d covers wear and tear

per bundle (which contained 1 ton) If not sent back the full value of the sacks is billed including use It is to the buyer s interest to have his own bags as it saves trouble and manufacturer s charges

Cement should be bought directly from the maker to save the middleman s profit and a number of the Thames and Medway cement merchants have depôts in London for this purpose It should also be purchased in large quantities such as a barge load at a time if possible and the saving thus effected would soon pay for the cost of a shed for storage Railway companies too specify a minimum rate for 4 tons Cement thus received can likewise be at once aerated by spreading it out about a foot thick on the dry floor of the shed which is very important Or if there is not sufficient storage accommodation good terms can still be obtained by contracting for the whole amount but with specified instalments It is an advantage to order delivery a few days forward as the cement has been made longer

Manufacturers (1900) whose capacity is $1\frac{1}{2}$ million tons per annum Cement is also imported from Germany and Belgium The price at the mills is 24*s* per ton and the cost delivered in London would be made up thus —

DETAILED COST OF PORTLAND CEMENT

		s	d
Portland cement at mills on Medway includ ng load ng into barges	per ton	24	0
Fre ght to London including unload ng and wharf charges		1	6
Cart ng from London wharf say 3 miles at 1*s* per mile		3	0
Use of bags 11 bags per ton at 2*d* each		1	10
Cost of returning empty bags say		0	8
Pr ce per short ton delivered		31	0

This works out to about 1*s* 6*d* prime cost per bushel for large quantities on site A convenient rate given for country districts is 2*s* per bushel

Cement is exported in fir casks lined with stout brown paper to prevent leakage and bound with ten wooden hoops and two iron ones each generally containing 4 centals or 400 lbs (net) Price 5*s* per cask including 2*s* for cost of barrel itself 6 casks = 1 ton net

Grey Lime —The grey chalk lime, called "stone" in London, is obtained from the lower chalk beds in the South of England at Dorking, Lewes, Petersfield, Halling, Merstham, &c, and is feebly hydraulic It weighs about 70 lbs per trade bushel A cubic yard costs 12*s*, delivered on site, and with 8 sacks (of 2 bushels each), or 16 trade bushels, to the yard, the charge would be 9*d* per bushel The ordinary ground Dorking or grey lime is now seldom kept in stock by London merchants, as the ground lias is much stronger, and cheaper also than formerly, and is brought up from the country in large quantities

When lime is purchased in sacks, it may be bought in the form of ground lime instead of lump at a small increased price, with, of course a further extra charge for the use of the sacks Grinding costs 1*s* per yard cube, included in foregoing rate which is for ground

Lias Lime —Lias lime, called "blue lias from the colour of the raw stone, comes mainly from the Midland and South-Western counties, chiefly *from such* places as Rugby, in Warwickshire Lyme Regis in Dorset, and Aberthaw, near Cardiff It is much more hydraulic than the stone lime Ground lias lime costs 25*s* per ton in the Metropolis, delivered on site, and as 1¼ yards equal 1 ton, the price per yard cube is 17*s* As there is an average of 32 bushels to the ton, the price per bushel works out to 10*d*, including use of bags There are 3 bushels of ground blue lias lime to the bag, or 11 bags make 1 ton If delivered by van within a radius of three miles or to any railway station in London, lime costs 1*s* per yard cube extra The detail of price is as below —

		s	*d*
Blue lias or Aberthaw lime in lump at works near Cardiff	per ton	8	0
Railway rate to Paddington		10	6
Carting in London to site 1 ton = 1¼ yds cube at 1*s* per yard		1	6
Use of 11 bags per ton at 2*d* each		1	10
Cost of returning empty bags say		1	8
Grinding 1 ton — 1¼ yds cube at 1*s* per yard		1	6
Price per ton delivered		25	0

Brick Rubbish —This is termed "rubbish" because the broken bricks &c, of which it is composed are generally obtained from old buildings pulled down, if not, the most inferior bricks brought on to the site must be utilised Such hard dry material is not only used for concrete

aggregate, but as a filling beneath concrete pavements A labourer can break to 2 in or 3 in cube 4 cubic yards per day, or 1 yard in $2\frac{1}{4}$ hours, and putting down 3*s.* for bricks, we have—

	s	d
Bricks for 1 cubic yard of rubbish, say	3	0
Breaking ditto, $2\frac{1}{4}$ hours labourer at 7*d*	1	6
	4	6
Add 20 per cent profit, &c	1	0
Total price per yard cube supplied only	5	6

for ordinary metalling or concrete, would only be a little more than half the weight of the solid rock For example, Kentish ragstone weighs 166 lbs per foot cube $\times 27 = \frac{4,482 \text{ lbs}}{2,240 \text{ lbs}} = 2$ tons per yard cube in the solid This is equivalent to 55 per cent, or say, 1 ton roundly, per yard cube for the broken stone

A labourer would break 2 cubic yards (measured after breaking) into 2 in gauge in a day, equal to 2*s* 8*d* per yard Hard rocks can only be broken at the rate of 1 yard, and granite at $\frac{1}{2}$ yard per day. Hand broken stone is sharper in fracture, as it is done by a blow, and not by gradual pressure, whereas machine broken stone is *often* flaky or with rounded edges, and, therefore, not so suitable for concrete

Stone can be broken much more expeditiously and cheaply by machine than by hand, provided the machine is at the quarry, so as to save the expense of much handling, and that the stone is too tough to be broken economically by hand The wear and tear of a stone breaking machine is very considerable, and it has been known to reach as high as 60 per cent of the first cost of the machine in one year If one of Baxter s knapping motion stone breakers, with a 16 in $\times$ 9 in jaw and 6 H P engine, be used, the quantity issuing per day of 10 hours is from 60 to 90 tons, and the metal falls from a screen in various sizes into divisions below As much as 18 tons have been broken in an hour, but taking 60 tons as an ordinary day s work, the cost of

breaking including the expenses of steam engine is as follows —

	£	s	d	£	s	d
Labour (4 men getting stone to and 5 taking it from machine)—9 men at 3s 6d per day	1	11	6			
Engine man at 5s per day	0	5	0			
Feeders 1 man at 4s	0	4	0			
1 boy at 2s 6d	0	2	6			
				2	3	0
Coals 5 cwt at 16s per ton				0	4	0
Oil and tallow about				0	1	0
Allow for depreciation and repairs (working 6 months)				0	4	0
Price of 60 tons				60)2	12	0
Price of 1 ton				0	0	10½

The sum is therefore 10½d per ton but allowing for time lost in moving from one place to another the actual cost is 1s per ton or per yard cube of broken stone (as already explained) as compared to 2s 8d for the same amount broken by hand—labour only in each case

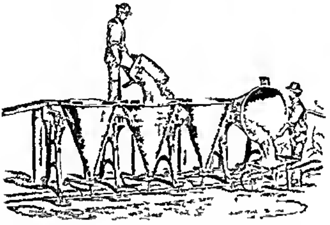
Sand —Sand is pit river or sea The sand used in London comes from the Thames or from pits at Fulham or the Drayton district and costs 7s per yard cube delivered in the City When screening is necessary the extra price would be 7d as 1 cubic yard is screened by a labourer in an hour at this wage

For hand washed sand a man will wash 1 yard cube measured after washing in 3 hours One fourth bulk is lost in the operation so allow 1¼ yard cube Water required 3 000 to 7 000 gals per cubic yard of sand treated according to dirtiness cost being conveniently included under the general item of Water for the Works but added below for complete analysis —

	s	d
1¼ yd cube sand at 7s per yard	8	9
4 000 gals water at say 9d per 1 000 gals	3	0
Labourer washing 3 hrs at 7d	1	9
Price per yard cube hand washed	13	6

For machine washing Walker's Patent Sand Washer is good No motive power is needed the cleansing being done by pressure from the water mains It can be used *singly or in batteries of any number* and each washer can be worked independently A single machine will wash ¼ yd cube per hour and a set of 6 will do 1½ to 3 yds per hour

according to impurity, which may be up to 25 per cent Labour is $\frac{1}{3}$ to $\frac{1}{4}$ of hand washing, and water only 1,000 to



Walker's Patent Sand Washers

1,300 gals per yd cube Each hopper full takes 15 to 20 minutes to become clean and 2 men can run a battery of 6 hoppers with an ordinary main pressure of water The following is based on an actual case with a set of 6 hoppers 2 men working 30 hours washed 50 yds cube or a man can manage 1 yd cube in 1½ hours

	s	d
1¼ yd cube sand at 7*s* per yard	8	9
1,250 gals water at say 9*d* per 1,000 gals	0	11¼
2 labourers 30 hrs at 7*d* per hour each ÷ 50 yds	0	8¼
Price per yd cube machine washed	10	5

Wheeling extra about 4*d* per yd cube if 50 to 100 yds Country rates much less Saving most noticeable where sand is in large quantities and frequently washed as in filter beds

The royalty for obtaining sand or gravel is 6*d* to 1*s* 6*d* per yard cube according to position and demand but 1*s* is a common rate

Concrete Work

The making of concrete depends upon—(1) the amount of voids in the aggregate which need to be filled with

the matrix; (2) the shrinkage of the matrix as a result of mixing with water, and (3) the compression in bulk of the whole of the materials after mixing, watering, and ramming

(1) *Voids in Aggregate*—The size of the pieces of which the aggregate is composed influences the content of the spaces or interstices between them, and therefore the amount of the lime, cement, and sand, in the matrix to fill these up The larger the stones the greater will be the voids between, and the vacancies can be best ascertained by actual trial—by filling a water tight box (a convenient size is 4 ft 6 in × 3 ft × 2 ft = 27 ft cube = 1 yd cube) with materials well wetted to avoid further absorption, and measuring the volume of water it is necessary to pour in to fill up all the interstices This gives the required amount of matrix and fine stuff, to which add allowance for shrinkage The cavities can be reduced by breaking the stones to as many different sizes as possible, to interlock and pack closer, which is very

matrix to get strong solid concrete Concrete should, in fact, contain as much broken material and as little mortar as possible, and stone crushing machines produce more irregular fragments, of various sizes, than stones broken by hand, though the latter are sharper

The following table shows the amount of voids in various aggregates, and therefore the matrix required to fill up —

VOIDS IN AGGREGATE

Description of Aggregate	Voids per Yard Cube	
	Ft. Cube	Per Cent
Brick broken ¾ in to 3 in gauge	13	48
Stone broken to 1 in gauge	12	45
" " 1½ in "	11¼	42
" " 2 in	10¾	40
" " 2½ in	10	37
Gravel of various sized pebbles	10	37
Clean shingle or burnt clay	9	33
Ordinary medium sand	9½	35
Clean pit sand	6	22
Thames ballast (⅔ gravel and ⅓ sand)	4½	17

(2) *Shrinkage of Matrix.*—The shrinkage in bulk of the lime and sand, or cement and sand, as a result of mixing with water when made into the mortar or matrix, must also be considered. Cement shrinks 10 per cent. when wetted, and sand 20 per cent. The diminution for lime and sand when mixed together and wetted is $\frac{1}{4}$, or 25 per cent., and for cement and sand, $\frac{1}{6}$ or 17 per cent. The reduction varies according to the proportion and nature of the ingredients and a useful table, giving a great deal of such information in relation to various mortars, will be found in Rivington's "Building Construction," Vol. III., which likewise contains other valuable matter on aggregates and concrete generally.

(3) *Compression of the Whole.*—The compression or shrinkage in bulk of the whole of the materials after mixing, watering and ramming in position, next claims attention. This depends upon the proportion of the concrete, the nature of the aggregate, upon its size, porosity, dryness or dampness, extent of ramming, &c. The greater the voids the greater the diminution. Such diminution may be as much as $\frac{1}{3}$ or as little as $\frac{1}{20}$, of the dry mixture, but with ordinary materials $\frac{1}{6}$ may be taken as an average. Ramming alone diminishes the bulk by $\frac{1}{10}$. The writer has proved this reduction in concrete in the following manner:—A bottomless box measure, 5 ft. 6 in. × 3 ft. 4 in. × 1 ft. 6 in. = 1 yard cube, was first filled with aggregate for concrete—Portland cement and gravel with sand, mixed dry. This, after being taken out of the box, was twice turned over and wetted, filled back again and well rammed, and was then found to have sunk $3\frac{1}{2}$ in., or about $\frac{1}{5}$. Therefore, when this concrete was wetted and rammed, it was reduced $\frac{1}{5}$ in bulk or 20 per cent. Thus 12 measures of this sized box made 10 yards cube of concrete.

All the foregoing lessenings of bulk must be taken into

broken brick, gravel, shingle, coke breeze, slag from furnaces, &c., for the aggregate, and lime or cement and sand for the matrix. When the aggregate is very rough and porous, the proportion of cement and sand should be greater, as a good deal is absorbed into the pores of the former.

Water for Concrete.—The amount of water depends upon the materials, their proportions and their absorbent nature. The mixing of neat cement requires 18 per cent. by weight

of water, *i e*, 2 gals per bushel of 112 lbs = 2 gals per $1\frac{1}{4}$ ft cube = 43 gals per yard cube Half only of this will be necessary for the whole bulk of the materials, or, generally speaking, $\frac{3}{4}$ to 1 gal per foot cube = 20 to 27 gals per yard cube of concrete These amounts agree with practice, for 22 gals per yard cube were used at Newhaven breakwater, 20 gals. at Spithead forts, where the concrete was 1 to 8, and 18 gals on the Chatham Dockyard Extension Works The aggregate should always be damp before mixing, but not dripping wet, so as to avoid undue absorption Allowing for waste, the average quantity may be taken at 25 gals per yard cube

The cost can be put down at $1\frac{1}{2}d$ per yard cube, which is the Metropolitan Water Board rate under Special Supplies, in the country it may be *nil*

Labour for Concrete —Allow at least 4 men for shovelling

r 5 to a gang, though

There is a ganger

is mixed at a

wheel 25 yards

cube per day

This equals $3\frac{1}{4}$ yards cube per man per day, or $2\frac{3}{4}$ hours per man per yard cube—say, 3 hours labourer, which will make up for the slightly higher wages of the ganger

Proportions —In the following cases, the proportions of lime or cement and sand should be taken with reference to the bulk of the ballast or shingle before mixing, and not to that of the whole of the materials when added together For

and

ingr

to 1 The concrete is 6 of gravel set in a mortar of 2 of sand to 1 of cement

A more exact method is to specify so many *bushels* or *cubic feet* of lime or cement to a cubic yard of concrete, *i e*, by volume, instead of vaguely by "parts which might imply non comparative and misleading weights

Table of Concretes —The annexed table is a summary of the amounts of materials for concrete as given by various authorities, but adapted and completed by the author for practical use

Examples

Example 1 —*Concrete composed of* 1 *part Grey Lime to* 6 *parts Thames Ballast* —This ballast contains the necessary sand, of which there is one third, the rest being gravel

(2) *Shrinkage of Matrix* —The shrinkage in bulk of the lime and sand, or cement and sand, as a result of mixing with water when made into the mortar or matrix, must also be considered Cement shrinks 10 per cent when wetted, and sand 20 per cent The diminution for lime and sand when mixed together and wetted is $\frac{1}{4}$, or 25 per cent, and for cement and sand, $\frac{1}{6}$ or 17 per cent The reduction varies according to the proportion and nature of the ingredients and a useful table, giving a great deal of such information in relation to various mortars will be found in Rivington's 'Building Construction, Vol III, which likewise contains other valuable matter on aggregates and concrete generally

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All the foregoing lessenings of bulk must be taken into consideration in calculating the additional materials required, but actual experience is the best guide

Materials for Concrete —These are ballast, broken stone,

of water i e 2 gals per bushel of 112 lbs = 2 gals per $1\frac{1}{4}$ ft cube = 43 gals per yard cube Half only of this will be necessary for the whole bulk of the materials or generally speaking $\frac{3}{4}$ to 1 gal per foot cube = 20 to 27 gals per yard cube of concrete These amounts agree with practice for 22 gals per yard cube were used at Newhaven breakwater 20 gals at Spithead forts where the concrete was 1 to 8 and 18 gals on the Chatham Dockyard Extension Works The aggregate should always be damp before mixing but not dripping wet so as to avoid undue absorption Allowing for waste the average quantity may be taken at 25 gals per yard cube

The cost can be put down at 1¼*d* per yard cube which is the Metropolitan Water Board rate under Special Supplies in the country it may be *nil*

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Table of Concretes —The annexed table is a summary of the amounts of materials for concrete as given by various authorities but adapted and completed by the author for practical use

EXAMPLES

EXAMPLE 1 —*Concrete composed of 1 part Grey Lime to 6 parts Thames Ballast* —This ballast contains the necessary sand of which there is one third the rest being gravel

MATERIALS FOR CONCRETE PER YARD CUBE

Description of Concrete	Grey Lime	Hydraulic or Lias Lime	Portland Cement	Water	Thames Ballast (contains ½ sand)	Gravel or Shingle	Broken Stone 1 to 2" cube	Broken Brick 1 to 2" cube	Sand	Labour
	Bushels	Bushels	Bushels	Gallons	Yards cube	Yards cube	Yards cube	Yards cube	Yards cube	Hours
Lime Concrete—										
1 grey lime to 6 Thames ballast	4	—	—	25	1⅓	—	—	—	—	3
1 ,, 7 ,,	3¾	—	—	30	1¼	—	—	—	—	Not given
1 ,, 10 ,,	2½	—	—	30	1⅓	—	—	—	—	
1 ,, 6 gravel and 2½ sand	3	—	—	30	—	1⅒	—	—	—	
1 ,, 6 shingle and 2 sand	3½	—	—	25	—	1	—	—	¼	
1 lias lime to 6 Thames ballast and 2 sand	—	4	—	25	1⅓	—	—	—	—	3
Cement Concrete—										
1 cement to 3 Thames ballast	—	—	7	25	1	—	—	—	—	Not given
1 ,, 4 ,,	—	—	5½	25	1	—	—	—	—	
1 ,, 5 ,,	—	—	4	25	1¼	—	—	—	—	
1 ,, 6 ,,	—	—	3¾	25	1¼	—	—	—	—	3
1 ,, 7 ,,	—	—	3¼	30	1⅛	—	—	—	—	Not given
1 ,, 10 ,,	—	—	2½	30	1⅓	—	—	—	—	
1 ,, 6 shingle and 2 sand	—	—	3½	25	—	1	—	—	½	
1 ,, 7 gravel and 3 sand (Potter)	—	—	2⅔	Not given	—	1	—	—	—	
1 ,, 8 ,, 3 ,, (Seddon)	—	—	2¼	18	—	1⅒	—	—	—	
1 ,, 6 broken stone and 2 sand	—	—	3¼	25	—	—	1	—	½	3
1 ,, 6 ,, brick ,,	—	—	4	12	—	—	—	1½	½	Not given

Note.—A bushel of cement in above table is taken as 112 lbs. Sand is not required for Thames ballast.

In practice about 33 ft cube, or $1\frac{1}{4}$ yards cube of ballast are allowed for each cubic yard of concrete, including waste, which will cover the compression of the whole. As there are $4\frac{1}{2}$ *ft. cube of voids per yard cube in Thames ballast*, this will be the amount of lime required, plus one fourth for shrinkage of lime and sand matrix when mixed together and wetted. (For reasoning see foregoing pages.) And $4\frac{1}{2}$ ft. cube × 6 (proportion of 1 to 6) = 27 ft cube, or 1 cubic yard. Therefore $4\frac{1}{2}$ ft cube + $\frac{1}{4}$th = $5\frac{1}{2}$ ft cube ÷ $1\frac{1}{4}$ ft cube per bushel = 4 bushels of lime per yard cube. For lime concrete the proportion of lime should be in lime powder, either hot ground or slaked lime, and not measured in the lump. Water, 25 gallons. Labour, 3 hours.

	s	d
$1\frac{1}{4}$ yard cube of Thames ballast at 5s 6d	6	7
4 bushels of grey lime at 9d	3	0
25 gallons of water	0	$1\frac{1}{2}$
Mixing, wheeling 25 yards, depositing, and ramming 3 hours labourer at 7d	1	9
	11	$5\frac{1}{2}$
Add 20 per cent profit, &c	2	$3\frac{1}{2}$
Total price per yard cube	13	9

When large quantities are mixed at once, there is a saving in both material and labour, resulting in a corresponding reduction of cost.

It [illegible]

[illegible] yards of ballast and 1 yard of lime (plus allowances for diminution) and so on so that the value of a larger quantity may be computed, and from that calculate the smaller by division.

EXAMPLE 2.—*Concrete composed of* 1 *part Lias or Hydraulic Lime to* 6 *parts Thames Ballast.*—In this instance the extra cost will only be the difference in price between grey lime and lias lime, and the analysis will be as before. When blue lias or hydraulic lime is used in the lump, it should

	s	d
[illegible] 6d	6	7
[illegible]	3	4
[illegible]	0	1½
[illegible]	1	9
	11	9½
Add 20 per cent profit &c	2	4½
Total price per yard cube	14	2

Example 3 —*Concrete composed of 1 part Portland Cement to 6 parts Thames Ballast* —The shrinkage for cement and sand matrix when mixed together and wetted is only one sixth Therefore 4¼ ft cube voids in aggregate + ⅙th = 5 ft cube − 1¼ ft cube per bushel = 3¾ bushels of cement per yard cube (1 2837 f c per bushel is exact) Cement concrete should be laid as soon as mixed

	s	d
[illegible]	6	7
[illegible]	5	7½
[illegible]	0	1½
[illegible]	1	9
	14	1
Add 20 per cent profit &c	2	5
Total price per yard cube	16	6

Example 4 —*Concrete composed of 1 part Portland Cement to 6 parts Broken Stone 1 to 2 in Gauge, and 2 parts Sand* — This is a very common make of concrete where ballast of any sort is not obtainable With reference to these proportions Mr Hurst says "As a rule 1 cubic yard of broken stone, screened gravel or clean shingle is required to make 1 cubic yard of concrete, but if the sand be increased beyond the above proportion, the quantity of shingle required is diminished, though in a somewhat less ratio than the sand"

	s	d
1 yard cube (27 ft cube) of stone, broken to 1 in gauge	11	0
⅓ yard cube (9 ft cube) of pit sand at 7*s*	2	4
⅙ yard cube (4½ ft cube) or 3¾ bushels of cement at 1*s* 6*d*	5	7
25 gallons of water	0	1
Labour, 3 hours at 7*d*	1	9
	20	10
Add 20 per cent profit &c	4	2
Total price per yard cube	25	0

[illegible] *[illegible]art Portland Cement to* [illegible] —The following is gi[illegible] and is for concrete walling 12 in thick Proportions 1 3 7

	s	d
[illegible]	4	0
[illegible]	6	7
[illegible]	2	6
[illegible]	0	9
[illegible]	0	6
Per yard cube including profit &c	14	4

EXAMPLE 6 —*Concrete Floor, 5 in thick, composed of 1 part Portland Cement to 6 parts Old Bricks, 1½ in Gauge* —This example is also from the same source Proportions, 1 2 6

	s	d
Crushing aggregate of old bricks by steam power labour only	0	8
4 bushels of Portland cement at 2s 6d	10	0
Labour mixing and depositing	2	0
Use and waste of material in timber supports and labour in preparing, fixing and removing same	3	0
Finishing surfaces by skimming floor with neat cement and ceiling with 1 cement to 3 sand	3	0
Per yard cube including profit &c	18	8

Equals 2s 7d per yard super

Concrete Bed for Paving &c, 6 in thick —A yard super of concrete 6 in thick would be one sixth of a yard cube, to which must be added the extra labour in spreading and levelling A man ought to do of this about 40 yards super per day, or, say, 1 yard in ¼ hour

	s	d
⅙ yard cube of cement concrete 1 to 6 at 14s 1d prime cost	2	4
¼ hour extra labour in spreading and levelling at 7d	0	2
	2	6
Add 20 per cent profit &c	0	6
Total price per yard super	3	0

A labourer will mix concrete outside a building, wheel 20 yards, and hoist to an upper floor with a bucket and rope, then spread and ram, 4 in thick, 5 yards super per man per day of 10 hours = 1 yd in 2 hrs ditto, 6 in thick, 4 yards super per man per day of 10 hours = 1 yd in 2½ hrs

Floating Surfaces of Concrete and bringing to a fair Face —In the proportion of 1 to 2, 1 bushel of cement and 2

bushels of sand will cover 5 yds super ⅜ in thick A bushel = 1/27 yard cube On a straightforward job a man can execute 20 yards super per day or about 1 y s in ½ hour

	s	d
1 bushel of Portland cement at 1s 6d	1	6
2 bushels or 2/27 yard cube of sand at 7s	0	8
Water say 2 gals at 1½d per 25 gals (see concrete)	0	0¼
Cost of 5 yards super	5)2	2¼
Cost of 1 yard super	0	5¼
Labour ½ hour bricklayer at 10½d	0	5¼
	0	10½
Add 20 per cent profit &c	0	2½
Total price per yard super	1	1

The above is merely a fair face and does not mean a thick finished surface for walking upon

Machine made Concrete —When large masses of concrete have to be made for engineering works it is more economical to employ concrete mixing machines which reduce the cost of making to one third of that done by hand These machines measure and mix the materials automatically and will turn out from 10 to 70 cubic yards of concrete per hour at 4d to 6d per yd cube for labour only They may be worked by hand power or by steam the latter necessitates engine boiler rails and tipping wagons &c Electric concrete mixers are also employed

Brick Filling —Broken brick dry filling 2 in cube under concrete floors and spread levelled and rammed 6 in thick A yard super of this is equal to one sixth of a yard cube and there is the labour in spreading and levelling

	s	d
⅙ yard cube broken brick rubbish at 4s 6d prime cost	0	9
¼ hour extra labour in spreading and levelling at 7d	0	2
	0	11
Add 20 per cent profit &c	0	2
Total price per yard super 6 in thick	1	1

CHAPTER VII.—DRAINLAYER.

MEMORANDA

Table of Drain Pipes

Internal Diameter	Net length when laid	Thickness of Pipe	Thickness of Socket	Depth of Socket	Weight per Pipe		Number per Ton
Stoneware	ft	in	in	in	cwt	lbs	No
3 in	2	[illegible]	[illegible]	1[illegible]	—	13	172 of 2 ft lengths
4 in	2	[illegible]	[illegible]	1[illegible]	—	18	121
5 in	2	[illegible]	[illegible]	1[illegible]	—	22	100
6 in	2	[illegible]	[illegible]	1[illegible]	—	32	70
9 in	2	[illegible]	[illegible]	2	—	58	80
10 in	2	[illegible]	[illegible]	2	—	70	32
12 in	2 to 2½	1	1	2	—	90	25
15 in	2 2½	1[illegible]	1[illegible]	2[illegible]	1	13	18
18 in	2 3	1[illegible]	1[illegible]	2[illegible]	1	75	12
21 in	2 3	1[illegible]	1[illegible]	2[illegible]	2	56	8
24 in	2 3	1[illegible]	1[illegible]	3	3	37	6
Cast Iron	ft						
3 in	9	[illegible]	[illegible]	3	1	0	20 of 9 ft lengths
4 in	9	[illegible]	[illegible]	4	1	48	14
5 in	9	[illegible]	[illegible]	4	[illegible]	0	10
6 in	9	[illegible]	[illegible]	4[illegible]	2	56	8
7 in	9	[illegible]	[illegible]	4[illegible]	3	98	6
8 in	9	[illegible]	[illegible]	4[illegible]	3	60	5½
9 in	9	[illegible]	[illegible]	4[illegible]	4	50	4½
10 in	9	[illegible]	[illegible]	4[illegible]	5	0	4
12 in	9	[illegible]	[illegible]	4[illegible]	6	80	3
15 in	12	[illegible]	[illegible]	4[illegible]	11	56	1[illegible] of 12 ft lengths
18 in	12	[illegible]	[illegible]	4[illegible]	15	0	1[illegible]
21 in	12	[illegible]	[illegible]	4[illegible]	18	64	1
24 in	12	[illegible]	[illegible]	4[illegible]	2?	0	[illegible]

Stoneware drain pipes are sometimes made in 3 ft lengths For joints 1 cwt of ¾ in tarred yarn or gaskin = 200 yds run It is put once round outside of spigot of pipe then cement run in Circum of pipe = $\frac{22}{7}$ diam

Cast iron drain pipes have jointing done with either "lead wool lead rope, molten lead, or with a rust joint

Latter is made of sal ammoniac, sulphur, and iron filings, mixed to a paste with water

Sewage Removal.—Allow 30 gals, or 5 ft cub, per head per day, equivalent to water supply

STONEWARE GULLIES AND TRAPS

Article	3 in		4 in		6 in		9 in		12 in	
	Each	Per Ton	Each	Per Ton	Each	Per Ton	Each	Per Ton.	Each	Per Ton
	lbs	No	lbs	No	lbs	No	lbs	No	lbs	No
Gullies and Siphons	11	203	15	150	33	68	68	33	90	25
S traps	10	224	18	124	36	62	—	—	—	—
P traps	7	320	11	203	28	80	—	—	—	—

FALL

Self cleansing gradients mean a velocity of 3 to 4 ft per sec for drains, and 2 to 3 ft for sewers, when depth of sewage is normally $\frac{1}{4}$ diameter of pipe

Maximum mean velocity is when depth of flow is $\frac{5}{6}$ ($= \frac{10}{12}$) diameter of pipe

Maximum discharge is when depth of flow is $\frac{11}{12}$ diameter of pipe and not when flowing full as might be supposed

' Decimal rule ' is handiest—Inch diam of pipe × 10 = gradient Thus —

FALL FOR DRAINS

4 in pipe × 10 = 1 in 40 gradient
6 in ,, × 10 = 1 in 60 ,,
9 in ,, × 10 = 1 in 90 ,,

FALL FOR SEWERS

(For these larger sizes lesser falls must be given)

12 in pipe = 1 in 200 gradient
15 in ,, = 1 in 300 ,,
18 in ,, = 1 in 400 ,,
21 in ,, = 1 in 500 ,,
24 in ,, = 1 in 600 ,,

Joints and Labour

Size of Pipe	1 bushel of neat cement will joint—		1 joint will require—	1 bushel of cement and 1 bushel of sand will joint—		1 joint will require—	A bricklayer and labourer will lay and joint— Per day		Per hour		1 F R. in—
	Pipe	Joints	Cement	Pipe	Joints	Cement and Sand	Pipe	Joints	Pipe	Joints	
in	F R.	No	Bushels	F R.	No	Bushels	F R.	No	F R.	No	Hours
4	82	41	$\frac{1}{41}$	150	75	$\frac{1}{75}$	90	45	10	5	$\frac{1}{10}$
6	56	28	$\frac{1}{28}$	100	50	$\frac{1}{50}$	60	30	7	$3\frac{1}{2}$	[illegible]
9	38	19	$\frac{1}{19}$	70	35	$\frac{1}{35}$	44	22	5	$2\frac{1}{2}$	[illegible]
12	28	14	$\frac{1}{14}$	50	25	$\frac{1}{25}$	32	16	4	2	[illegible]
15	22	11	$\frac{1}{11}$	40	20	$\frac{1}{20}$	24	12	3	$1\frac{1}{2}$	[illegible]
18	16	8	$\frac{1}{8}$	30	15	$\frac{1}{15}$	18	9	2	1	[illegible]

1 joint per 2 ft length of pipe 1 bushel = 1.284 c f 1 day = 9 hrs

Strength of Drains

Stoneware drains should resist an internal or bursting pressure of 100 lbs per sq in, which in a 6 in pipe equals 20 tons per 2 ft length They have even stood 200 lbs per sq in

In practice underground pipes would not be crushed, because the overlying soil also presses sideways, forming a self supporting tunnel like a rabbit hole

Testing Drains

Testing stoneware drains with water, per 10 ft run —

Size of Pipe	Water required Per 1 ft run	Per 10 ft run	Bricklayer and Labourer	Head or pressure of water of 24 hours duration after joints made at least 48 hours Minimum	Maximum
in	gals	gals	Hrs per 10ft run		
4	$\frac{1}{2}$	$5\frac{1}{4}$	.55		
6	$1\frac{1}{4}$	12	.59	5 ft head	10 ft head
9	$2\frac{7}{10}$	27	.66	or	or
12	$4\frac{3}{4}$	48	.80	2.16 lbs	4.33 lbs
15	$7\frac{1}{2}$	75	.95	per sq in	per sq in
18	$10\frac{3}{4}$	108	1.20		

Cast Iron —For cast iron drains with caulked lead joints allow a minimum working pressure of 20 ft head or 7 lbs per sq in and maximum 200 ft head or 87 lbs per sq in

Carting Drain Pipes

Size of special one horse van for carting drain pipes in London 9 ft × 4 ft 9 in × 2 ft

Capacity of van—200 of	4 in	pipes
120	6 in	
55	9 in	
35 ,,	12 in	
22	15 in	
18	18 in	

Average one horse van is about 9 ft × 4 ft × 2 ft and carries 2 tons

Pipe Trenches

In digging width at bottom of trenches should be at least 1 ft in addition to diameter of pipe (*i e* 6 in each side) to enable the men to get their hands all round the sockets when jointing 2 ft wide therefore is sufficient for pipes from 4 to 12 in diameter

Concrete under Pipes

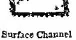
Cement concrete (1 to 6) beds under drain pipes are 12 in wider than the pipes laid to falls haunched up against sides of pipes and of varying thicknesses as below —

	in		ft	in			in	
Bed for	4	pipes	1	4	wide	×	3	thick
	6		1	6		×	3½	
	9		1	9		×	4	
	12		2	0		×	4½	
	15		2	3		×	5½	
	18		2	6		×	6	

Concrete Surface Channels

Concrete 12 in × 4 in	with channel	6 in wide
15 in × 4 in		9 in
18 in × 6 in		12 in
24 in × 6 in		18 in

Depth of channel varies according to fall



Surface Channel

Subsoil Drainage.

Weight of Agricultural Drains

1 000 of 2 in pipes in 12 in or 15 in. lengths, weigh	17	to	19 cwt.
" 2½ in " " " " "	24	"	26 "
" 3 in " " " " "	34	"	36 "
" 4 in " " " " "	45	"	47 "
" 6 in " " " " "	100	"	102 "

Loading of Agricultural Drains.

2 [illegible]
3 [illegible]
4 [illegible]
6 [illegible]

Drainage of Land

Soils	Distance of Drains apart	Depth of Drains	Pipes, 12 in. long, per acre
Compact or Heavy Soils	ft	ft in	No
Compact clay	6	2 0	7,260
Tenacious clay	9	2 0	4,840
Gravelly clay	12	2 6	3 630
Stiff adhesive clay	15	2 6	2,905
Friable clay	18	2 9	2 420
Free soft clay	21	2 9	2 070
Medium Soils			
Clayey loam	22	3 0	1,980
Marly loam	24	3 0	1 815
Gravelly loam	27	3 3	1,613
Friable loam	30	3 3	1,452
Porous or Light Soils			
Light gravelly loam	33	3 6	1,320
Light marly loam	36	3 9	1,209
Sandy loam	39	4 0	1,117
Soft light loam	42	4 0	1 037
Sandy soil	45	4 0	970
Light gravelly sand	50	4 3	874
Deep gravelly sand	55	4 3	792
Coarse gravelly sand	60	4 6	726
Loose gravelly sand	66	4 6	660

Agricultural, or subsoil, pipes are laid dry without jointing material and ends simply abutting 12 in or 15 in lengths. Depths and distances apart vary according t nature of soil Gradients as surface of ground, but n lateral fall less than 1 in 100

1 acre = 70 yds (nearly) each way = 4 840 y s = 43 560 f s

Brick Sewers.

Bricks required per Yard Run of Barrel Drain

Thickness of Brickwork.	Internal Diameter of Drain	1½ Brickwork per yard run	Bricks required per yard run
in	ft in	ft sup	No
4½	1 0	4½	70
4½	1 6	6	96
4½	2 0	7½	120
9	2 0	17½	282
9	2 6	20½	332
13½	2 6	35	558
9	3 0	23½	382
13½	3 0	39½	628
9	3 6	27	432
13½	3 6	44	708
9	4 0	31	484
13½	4 0	50	782
13½	5 0	58	928
18	5 0	81	1,308
13½	6 0	68	1,084
18	6 0	94	1 518

PRICES

Digging for Drains.

Description		Made Ground		Common Ground		Stiff Clay, Gravel or Loose Chalk	
Excavating trenches for drains, water and		s	d	s	d	s	d
	run	0	1½	0	2	0	2½
	„	0	3	0	3½	0	4
	„	0	4½	0	5	0	6
	„	0	7	0	8	0	9
	„	0	8	0	9½	0	11
	„	1	0	1	2	1	4

Stoneware Drain Pipes

There is a London Pipe Tariff, or list price at warehouse, and the following rates are for best quality after deducting discount Free delivery by town merchants within 5 miles if a cart load is ordered

Glazed Stoneware Drain Pipes &c
(Trade discount deducted)

Description		4-in Supplied only	4-in Laid and jointed	6-in Supplied only	6-in Laid and jointed	9-in Supplied only	9-in Laid and jointed	12-in Supplied only	12-in Laid and jointed	15-in Supplied only	15-in Laid and jointed	18-in Supplied only	18-in Laid and jointed
		s d	s d	s d	s d	s d	s d	s d	s d	s d	s d	s d	s d
Plain socketed pipes in 2 ft. lengths	per ft. run	[illegible] 4	0 ½	0 6	0 10	0 10	1 4	1 5	[illegible] 0	2 4	3 5	3 7	4 10
Bends any sweep	each	1 0	0 7	1 6	0	6	1 3	4 3	1 11	7 0	2 10	10 9	4 3
Taper pieces 2 ft. long		1 4	0 10	0	1 2	1 4	1 10	5 8	3 4	9 4	[illegible] 6	14 4	8 2
Single junctions ditto		1 4	0 11	2 0	1 2	3 4	1 10	5 9	8 4	9 4	5 6	14 4	8 [illegible]
Double junctions ditto		2 0	1 4	3 0	1 [illegible]	5 0	3 0	8	5 1	14 0	8 4	21 6	1[illegible] 0
Syphon traps without cleaning eye		[illegible] 6	3 6	3 3	4 [illegible]	4 4	8 6	10 4	12 10	—	—	—	—
Syphon traps with cleaning eye		2 10	3 10	4 0	5 6	7 0	[illegible] 0	11 0	13 0	—	—	—	—
Block or closet traps		1	8	3 6	4	6 0	0	—	—	—	—	—	—
Traps square or round for yards &c.		3 0	4 0	4 0	[illegible] 0	[illegible] 0	7 6	[illegible] 0	11 0	—	—	—	—
Iron gratings for yard gullies any shape		0 4	—	0 7	—	1 3	—	[illegible] 4	—	—	—	—	—
Galvanised ditto ditto		0 8	—	1	—	6	—	4 6	—	—	—	—	—
Weatherill's, Buchan's or similar disconnecting trap for manholes		6 0	10 0	10 6	13 0	17 6	0 0	—	—	—	—	—	—
Flap traps with ground faces and galvanised flaps for outlets		3 6	—	4 6	—	7 6	—	1 0	—	[illegible] 0	—	40 0	—
Cutting pipes, bends, taper pieces, junctions, &c., square or splayed, including risk of breakage, labour only	each cut	0 5	—	0	—	0 10	—	1 0	—	1 3	—	1 6	—
White glazed stoneware straight channel pipes for manholes	per ft. run	0 8	1 1	1 0	1	1 8	4	3	3 0	—	—	—	—
Brown glazed ditto ditto ditto		0 6	0 10	0 8	1 1	1 3	1 [illegible]	1	3	—	—	—	—
White glazed bends for channels any sweep	each	[illegible] 0	2 8	1 0	3 [illegible]	[illegible] 0	[illegible] 9	6 9	7 8	—	—	—	—
Brown glazed ditto ditto ditto		1 7	3	4	3 0	3 10	4 6	4 3	6 0	—	—	—	—
Cutting square or splayed ends to ditto, including risk of breakage	each cut	0 0	—	0 9	—	1 [illegible]	—	1 6	—	—	—	—	—

Pipe Trenches.—Digging, filling in and ramming taken separately under Digging for Drains.

Discount

Trade discount	45 per cent	for	4 in	pipes
	45	,,	6 in	,,
	40	,,	9 in	,,
	35	,,	12 in	,,
	33	,,	15 in	,,
	33	,,	18 in	

Selected pipes are 10 per cent over ordinary prices
Selected and tested 20 ,, ,,
Midland district prices are 5 to 10 per cent less

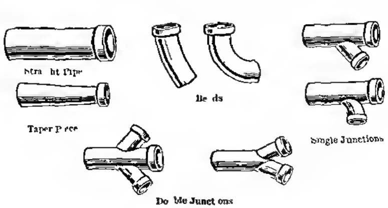
Lengths of Bends &c

In length a bend	= 1½ ft	drain pipe
taper piece	= 2 ft	,, ,,
single junction	= 2 ft	,, ,,
double junction	= 3 ft	,, ,,

Pricing of Bends &c

Bends &c are 3 times price of 1 ft straight pipe
Taper pieces are 4 ,, ,,

The prices of bends taper pieces junctions &c in column ' Laid and jointed ' are *extra only* over the cost of pipes Also see Analysis



MISCELLANEOUS

Description		s	d	s	d
Ends of drain pipes made good to pipes, down		0	[illegible]		[illegible]
		[illegible]	[illegible]	[illegible]	[illegible]
Drain pipes and connections taken up, cleaned, and stacked (excluding digging)	per ft run	0	[illegible]	0	[illegible]
Gully traps siphons, &c ditto ditto	each	[illegible]	[illegible]	[illegible]	[illegible]
Testing drains by smoke or scent test	"	[illegible]	[illegible]	[illegible]	[illegible]
Ditto ditto by water test	per 10 ft run	1	0	[illegible]	[illegible]
	each	[illegible]	[illegible]		
	"	10	[illegible]		
	"	[illegible]	0		
	"	15	0		

CONCRETE BEDS

Concrete bed

Cement concrete bed (1 to 6) under pipes, 12 in wider than pipes, laid to falls, and flaunched against sides of pipes, with varying thicknesses, as follows —

		s	d
1 ft 4 in wide × 3 in thick for 4 in pipe	per ft run	0	7
1 ft 6 in " × 3½ in " " 6-in "	"	0	9
1 ft 9 in " × 4 in " " 9 in "	"	1	0
2 ft 0 in " × 4½ in " " 12 in "	"	1	3
2 ft 3 in " × 5½ in " " 15 in "	"	1	6
2 ft 6 in " × 6 in " " 18 in "	"	1	1[illegible]

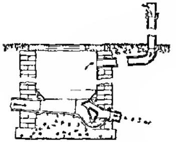
CHANNELS

		s	d
9 in × 6 in Portland cement concrete (1 to 4) surface channel dished 6 in wide and laid to current excluding digging	per ft run	1	0
Extra for stopped end	each	0	2
" " external rounded angle	"	1	0
" " internal mitred angle	"	1	0

MANHOLES

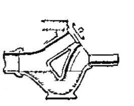
		s	d
P C concrete foundation to manholes 1 to 6 in small quantities	per yd cub	17	0
Stock brickwork in sides of manholes 1 B thick in cement mortar 1 to 3	per ft cub	1	3
Extra only for best white glazed bricks to sides pointed with cement	per ft sup	2	2

MANHOLES—*continued*



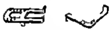
Manhole

Patent Channel Bend



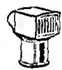
Intercepting Trap

		s	d
Rendering sides and soffits of manholes with cement and washed sand (1 to 2) ¾ in thick trowelled hard and smooth	per yd sup	2	6
Ditto in narrow widths under 6 in wide	,,	3	6
Cement angle fillets to manholes and mitres	per ft run	0	1½
Galvanised step irons for manholes, heavy pattern 9 lbs each supplied only	each	2	1
Ditto ditto angle pattern, supplied only	,,	2	0



Step Irons

Manhole Cover



Air Inlet.

		s	d
Jones patent double air tight iron covers for man holes 6 in deep 26 in by 20 in painted	each	40	0
Ditto ditto galvanised	,,	60	0
Broads Premier covers double cover with double or triple seals No 20 24 in × 16 in	,,	46	6
Add for setting manhole covers and frames in cement		3	0
Air inlet ventilators, with brass fronts L C C pattern 4 in pipe		3	0

GULLIES

Gully Grids

		s	d
Glazed stoneware gully traps with galvanised iron gratings and set in cement, including digging and filling in —			
6-in grating with 4 in outlet	each	6	9
9 in ,, ,, 4 in ,,	,,	8	10
9 in ,, ,, 6 in ,,	,,	13	0

GULLIES—*continued*

		s	d
Digging and setting only	each	2	0
Broads' Combined domestic gully creamware		10	6
Broads' "Augean" stable gully creamware		14	6
Broads' Gulliver inspection yard gully creamware		10	6
Jennings' stoneware yard gullies 9½ in × 9½ in with 4 in outlet s o		4	6
Ditto ditto 11½ in × 11½ in with 6 in ditto ditto		7	6
York stone covers for gullies tooled on top and edges dished 1 in deep and 1 in from edge all round to centre perforated for gully gratings and mortised for lugs 12 in × 12 in × 4 in thick		5	0
Add if bedded with cement and set complete		0	6
Ditto ditto 15 in × 15 in × 4 in thick		6	0
Add if bedded with cement and set complete		0	8
Ditto ditto 18 in × 18 in × 4 in thick		8	0
Add if bedded with cement and set complete		0	9
Cast iron gully traps 18 in × 13 in × 20 in deep 4 in outlet and hinged grid s o		35	0

Yard Gully

Kitchen Sink

Iron Gully

SINKS

		s	d
Cane glazed inside and out fireclay kitchen sinks supplied only 21 in × 16 in × 7 in	each	9	0
Ditto ditto 27 in × 18 in × 7 in		11	0
Ditto ditto 30 in × 18 in × 7 in		13	0
Ditto ditto 36 in × 21 in × 7 in		17	0
Add to foregoing four items if set in cement		3	0
If white glazed inside add 40 % to above prices			
Broads' bucket interceptor sinks in white enamelled and creamware	from	12	6

CONNECTIONS

		s	d
St George's Hanover Square vestry rate for connecting 6 in drain with sewer inserting flap trap and two lengths of pipe (the builder digs and fills in)	each	15	0
Ditto ditto for connecting 9 in drain with sewer		19	0
Ditto ditto ditto 12 in ditto		26	0

MATERIALS

		s	d
Portland cement	per bushel	1	6
Sand pit or river, clean sharp, unwashed	per yd cube	7	0
Gaskin, white, hemp, in balls of 7, 14, or 28 lbs	per cwt	56	0
„ „ jute, „ „ „ „	„	30	0
„ tarred, hemp, „ „ „ „	„	50	0
„ „ jute, „ „ „ „	„	26	0

WAGES

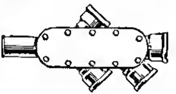
Wages, excavator	per hour	0	7½
„ general labourer	„	0	7
„ bricklayer	„	0	10½
„ bricklayer's labourer	„	0	7

AGRICULTURAL DRAIN PIPES

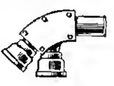
Description	2 in		3 in		4 in		6 in	
	s	d	s	d	s	d	s	d
Agricultural or unglazed earthenware drain pipes in 12 in lengths, supplied only per thousand	35	0	60	0	90	0	180	0
Ditto, laying only per yd run	0	0½	0	1	0	1½	0	3
Ditto, laid complete (exclusive of digging) per yd run	0	2½	0	4	0	6	0	11

		£	s	d
Cost of draining clay land, including digging filling pipes and laying when the agricultural pipes are 6 yds apart	per acre	9	0	0
Ditto ditto 7 yds apart	„	7	10	0
Ditto ditto 8 yds „	„	6	0	0

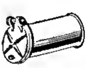
CAST-IRON DRAINS



C I Inspection Chamber



C I Bend



Flap Valve

Description	4 in				6 in			
	Supplied only		Laid and jointed		Supplied only		Laid and jointed	
	s	d	s	d	s	d	s	d
	1	6	2	3	2	4	3	6

CAST IRON DRAINS—*continued.*

Description.		4 in Supplied only *s*	*d*	4 in Laid and jointed *s*	*d*	6-in Supplied only. *s*	*d*	6-in Laid and jointed *s*	*d.*
Extra for taper or diminishing pipes, all descriptions	each	3	6	4	9	6	2	8	6
Ditto for taper or diminishing pipes, all descriptions, with socket at each end	„	4	2	5	6	7	3	9	9
Ditto for ordinary bends, ⅜ in metal, any radius	„	5	4	6	6	10	0	10	9
Ditto for junctions, ⅜ in metal, ordinary angles	„	7	6	8	9	13	6	14	8
Inspection piece with 4 in ventilating arm, with large shallow socket for cover	„	9	6	13	6	11	3	17	3
Cast iron inspection chamber, coated with Dr Smith's solution, complete with cover, galv bolts and gunmetal nuts, rubber washer, with 3 inlets (135°)	„	58	0	62	0	87	0	93	0
Cast iron inspection chamber bends, ditto ditto, with 1 inlet	„	31	0	34	0	42	0	46	0
Cast iron flap valve, with gun metal hinges and machined faces	„	23	0	26	0	32	0	37	0
Cast iron sewer gas trap ⅜ in metal Macfarlane's No 134 *d*	„	22	6	30	6	40	0	51	0
Ditto, ditto, No 137 *d*, with inspection eye	„	21	3	29	3	40	3	51	3
Mica flap air inlet, ordinary size, of galvanised cast iron and approved make with brass grating Jones patent 	„	7	6	9	0	13	0	14	9

ANALYSIS

Drain pipes are measured at per foot run, the digging being best taken separately beforehand Sometimes the digging, laying and jointing pipes, and filling in and ramming, are all lumped together, the depth of excavation being averaged and stated, but this system only mixes up two different kinds of work. For joints and labour, &c, see tables in Memoranda.

The valuation can then be easily shown in detail

4 in glazed Stoneware Drain Pipes, Laid and Jointed with Cement —The prices of pipes can be extracted from the table given on previous page The railway rates are generally for 2 ton lots and upwards Each length measures 2 ft, exclusive of socket A bushel of cement will suffice for 41 joints, or $\frac{1}{41}$ bushel per joint

	s	d
1	0	4
	0	0½
...cklayer 10½*d* and	0	1¾
	0	6¼
Add 20 per cent profit &c	0	1¼
Total price per foot run	0	7½

When digging is included the width at bottom of trenches should be at least 1 ft in addition to the diameter of the pipe, to enable the men to get their hands all round the sockets when jointing, 2 ft ought therefore to be sufficient for pipes from 4 in to 12 in diameter A common and ready method of charging this is to put down 1*d* per foot run for each foot in depth The cost of a trench 3 ft deep may therefore be priced at 3*d* per foot run though higher rates are shown under the heading "Digging for Drains" in Prices

Bends extra only over Cost of Pipes —These having been already measured in the straight piping are now merely

bend in length, then extra only for a 4 in bend would be —

	s	d
Price of 4 in bend supplied only	1	0
Deduct price of 1½ ft of 4 in pipe at 4*d*	0	6
	0	6
Add 20 per cent profit	0	1
Total price extra only	0	7

Taper pieces and single junctions may be taken as equivalent to 2 ft of pipe, and double junctions to 3 ft of pipe These, therefore are the lengths deducted for "extra only" in laying and jointing

Siphon Traps, without Cleaning Eye, and set in Cement — This would be dealt with as below, supposing the trap to equal 2 ft of pipe It would probably be set in a manhole

	s	d
4 in siphon trap without cleaning eye	2	6
Cement for jointing and setting	0	1
Labour in setting = twice that for 1 ft of 4 in pipe	0	3½
	2	10½
Add 20 per cent profit &c	0	7½
Total price of each	3	6

Glazed Stoneware Gully Trap, 9 in Grating with 4 in Outlet, and set in Cement, including Digging and Filling in —

1 6
1 6
1 3

	s	d
	0	1¼
	0	0½
	6	0
	0	1¼
hour at 1s 5¼*l*	1	1
	7	4
Add 20 per cent profit &c	1	6
Total price of each	8	10

If a concrete bed is necessary then add or in Concretor

Ends of Drain Pipes made good to Pits Down pipes, &c, including Cutting and Cement 4 in to 9 in —This is only labour and a little cement

	s	d
Labour ¾ hour bricklayer at 10¼*l*	0	8
Cement for connecting	0	2
	0	10
Add 20 per cent profit &c	0	2
Total price of each	1	0

Testing Drains

Testing 4 in drain pipe by Water Test —For a length of 10 ft, 5¼ gals of water will be required and ½ hour bricklayer and labourer —

	s	d
½ hour bricklayer and labourer at 10½*d* and 7*d*	0	8¾
5¼ gals water and waste	0	0¼
Use of plug &c	0	0½
	0	9½
Add 20 per cent profit &c	0	1½
Price per 10 ft run	0	11

Agricultural Drain Pipes

These are measured by the yard run, and for large areas in connection with subsoil drainage by the acre including material and digging They are laid dry, without any cementing stuff, and their ends simply abutting

S b40 l Dra n

The trenches are very narrow, wider at the top than at the bottom and cut with special shaped spades the pipes being laid at various depths and distances apart according to the nature of the subsoil Such data being given, the length of piping and cost of excavation can readily be ascertained An acre contains 4 840 square yards, or say 69¾ yards run each way The labour in laying per lineal yard would vary from ½*d* for 2 in pipes to 3*d* for 6 in pipes Each length is 12 in or 15 in and for 12 in lengths the laying in detail would appear—

	s	d
1 yard 2 in agricultural pipes $= \frac{3}{1000}$ at 30s per thousand	0	1¼
Labour in laying ditto	0	0½
	0	1¾
Add profit	0	0½
Total price per yard run	0	2¼

If the item includes digging then the cost of this must also be worked out and added

CHAPTER VIII.—BRICKLAYER.

MEMORANDA.

Size and Weight of Bricks

Kind of Brick.	Size	Weight	Weight per Thousand
	in in in	lb	cwt
London stock	$8\frac{3}{4} \times 4\frac{1}{4} \times 2\frac{3}{4}$	$6\frac{1}{4}$	60
Red kiln	$8\frac{3}{4} \times 4\frac{1}{4} \times 2\frac{3}{4}$	7	$62\frac{1}{2}$
Fareham red	$8\frac{1}{2} \times 4\frac{1}{8} \times 2\frac{1}{2}$	6	$53\frac{1}{2}$
Stourbridge firebrick	$9 \times 4\frac{1}{2} \times 2\frac{3}{4}$	$7\frac{3}{4}$	69
Welsh firebrick	$9 \times 4\frac{1}{2} \times 2\frac{3}{4}$	8	71
Staffordshire blue	$9 \times 4\frac{1}{2} \times 3$	10	90
Staffordshire blue, 8 panel, paving	$9 \times 4\frac{1}{2} \times 3$	9	80
Candy's buff vitrified stable paving	$9 \times 4\frac{1}{2} \times 2\frac{1}{4}$	$6\frac{1}{2}$	58
Dutch clinker	$6\frac{1}{4} \times 3 \times 1\frac{1}{2}$	$1\frac{1}{2}$	13
Glazed brick	$9 \times 4\frac{1}{2} \times 2\frac{5}{8}$	$7\frac{1}{4}$	65
Coke breeze brick 1 to 5	$9 \times 4\frac{1}{2} \times 3$	$4\frac{1}{4}$	$42\frac{1}{2}$

Absorption.—Ordinary bricks absorb $\frac{1}{6}$th or $\frac{1}{8}$th of their weight in water after 24 hours immersion; Blue Staffordshire, or similar bricks, $\frac{1}{15}$th or $\frac{1}{20}$th

Standard Thickness

$1\frac{1}{2}$ brick, or 1

A rod, or squar

Rule.—To re

multiply the superficial content of the wall by the number of half bricks in its thickness, and divide the result by 3, which

number of rods of *reduced* brickwork, or brickwork reduced to the standard thickness of $1\frac{1}{2}$ brick.

To reduce cubic feet to the standard thickness, multiply by 8 (the number of $1\frac{1}{2}$ in in 1 ft) and divide by 9 (the number of $1\frac{1}{2}$ in in $1\frac{1}{2}$ brick). In other words, deduct $\frac{1}{9}$th.

A Rod of Brickwork

$= 16\frac{1}{2}$ ft $\times 16\frac{1}{2}$ ft $= 272\frac{1}{4}$ ft super of standard thickness of brickwork
$= 16\frac{1}{2}$ ft $\times 16\frac{1}{2}$ ft $\times 1\frac{1}{8}$ ft
$= 306\frac{1}{4}$ ft cube
$= 11\frac{1}{4}$ yards cube
$= 30\frac{1}{4}$ yards super $1\frac{1}{2}$ brick thick
$= 45\frac{1}{3}$ yards super 1 brick thick
$= 816$ ft super $\frac{1}{2}$ brick thick
$= 408$ " 1 " "
$= 272$ " $1\frac{1}{2}$ " "
$= 204$ " 2 " "
$= 163$ " $2\frac{1}{2}$ " "
$= 136$ " 3 " "
$= 6\frac{1}{2}$ roods super 1 brick thick

in joints
including waste

Other Units

1 cubic foot of brickwork requires 14 bricks, net
1 " " " 15 " gross
1 cubic yard " " 385 " net
1 " " " 390 " gross
1 square yard, $1\frac{1}{2}$ brick thick $= 144$ bricks
1 rood of reduced brickwork $= 63$ ft super 1 brick thick

Superficial Measure.

1 ft super of reduced brickwork requires 16 bricks
" gauged arches " 10 "
" facing (English bond) " 8 "
"
1 bricks
"
"
"
"
"
"
"

Brick Facings, &c

1 yard super requires 72 bricks and $\frac{1}{4}$ ft cube mortar, English bond
" " 64 " $\frac{1}{5}$ " " Flemish bond
" " 48 " $\frac{1}{4}$ " " $\frac{1}{2}$ brick walling

Brick Nogging

1 yard super requires 48 bricks laid flat, and $\frac{3}{4}$ ft cube of mortar
" " 32 " laid on edge, and $\frac{1}{4}$ ft cube of mortar.

Brick Paving.

Description	Size	No per yd super	Mortar
	in in in		ft cube
Stock bricks laid flat	8¾ × 4¼ × 2¾	35	1
" " " on edge	8¾ × 4¼ × 2¾	52	1½
Paving bricks laid flat	9 × 4½ × 2	32	1
" " " on edge	9 × 4½ × 2	72	2
Dutch clinkers laid flat	6¼ × 3 × 1½	70	2
" " " on edge	6¼ × 3 × 1½	140	2½
" " " herring bone flat	6¼ × 3 × 1½	75	2
Dutch clinkers laid herring bone on edge	6¼ × 3 × 1½	150	2½
Blue Staffordshire 8 panel paving bricks, bevelled edges	9 × 4½ × 3	32	1
Candy's "Olympia" buff vitrified stable paving bricks with two longitudinal grooves laid straight	9 × 4½ × 2¾	32	1
Ditto, ditto, laid diagonally	9 × 4½ × 2¾	22 and 13 mitre blocks	1

Tile Paving

Shape	Size	Thickness	Weight of each	Weight per 100	No per yd super
	in in	in	lbs	cwt.	
Square	12 × 12	1½	13	11½	9
"	10 × 10	1¼	8	7	13
"	9 × 9	1	5½	5	16
"	6 × 6	¾	2¼	2	36
"	4 × 4	⅝	1¼	1	81
"	3 × 3	½	½	½	144
Hexagon	6 × 6	¾	1¾	1½	36
"	6 × 6	1	2	2	36
Paving	9 × 4½	1⅞	5	4½	32

Ceramic mosaic pavements ¼ in thick 40 y s = 1 ton
" " ⅛ in " 50 " = 1 "

Weight of Brickwork

1 ft cube in lime mortar weighs 110 lbs
1 ft cube in cement mortar weighs 112 lbs

Stacking

A stack = 1 000 *new bricks closely packed* occupying 50 to 55 ft cube
A stack = 1 000 old bricks loosely packed, occupying 65 to 70 ft cube

Loading

A load of mortar — 1 yd cube — 40 hods — 21 bushels = 27 ft cube

Bricklayer s Hod

Size = 16 in × 9 in × 9 in
Capacity for bricks 20 stock or 16 walling or 12 facing but number ordinarily carried is 12
Capacity for mortar — $\frac{3}{4}$ ft cube or nearly $\frac{1}{2}$ bushel sufficient to lay 20 bricks

Clay for Bricks

Maximum profitable depth for working brick clay is 30 ft
An acre of brick earth a foot thick will make $\frac{1}{2}$ million bricks
a yard 2
3 yds cube of strong clay measured before digging will make 1 000 bricks
2 mild
1 yd cube will therefore make 330 to 500 bricks
Royalty for obtaining clay varies from *1s* to *2s 9d* per yd cube
Freehold land suitable for brickmaking costs about £200 an acre

Fuel for Bricks

Fuel for Scotch kiln	8 to 11 cwts per 1 000 bricks
Intermittent kiln	5 to 8
Hoffman kiln	$1\frac{1}{2}$ to 3
Clamp burning requires	$\frac{3}{4}$ cwt breeze
Scotch kiln requires	10 cwt soft coal
Hoffman kiln requires	$2\frac{1}{2}$ cwt coal slack

Mortar

1 ft cube of lime mortar 1 to 2 = 125 lbs
18 = 1 ton
1 cement mortar 1 to 2 130 lbs
17 1 ton
1 yd cube of lime mortar 1 to 2 = $1\frac{1}{2}$ ton
1 yd cube of Portland cement = 1 ton

Fireclay

Weight per foot cube — 65 to 85 lbs
1 sack of fire clay = 2 cwt
1 cask — 2, 4 or 10 cwt

Terra cotta

b
1
1

Weight.—If solid, 120 to 122 lbs per ft. cube
If hollow, 60 to 70 lbs " "

[illegible]

10 per cent of its weight

PRICES

The following prices apply to every description of brickwork, such as straight, and oblique walls, manholes, tanks, and all similar work, executed to any height, and including labour, plant, scaffolding, supervision, profit, and establishment charges, &c.

Brickwork

Description	Per Rod			Per Yard Cube			Per Foot Cube	
	£	s	d	£	s	d	s	d
Stock brickwork, materials and labour walls 1½ brick or over, in grey chalk lime mortar, 1 to 2	16	5	2	1	9	0	1	0¾
Ditto, ditto, ditto, 1 to 3	16	2	6	1	8	6	1	0½
Ditto, in blue lias or Aberthaw lime mortar	20	15	0	1	9	6	1	1
Ditto, in neat cement	21	3	0	1	14	6	1	4½
Ditto, in cement mortar 1 to 1	19	10	0	1	14	6	1	3
Ditto, ditto, 1 to 2	18	6	5	1	12	5	1	2¼
Ditto, ditto, 1 to 3	18	3	6	1	12	1	1	2
Ditto, ditto, 1 to 4	17	15	6	1	11	4	1	1¾
Add if in 1 brick walls	0	11	6	0	1	0	0	0½
Ditto, ½ brick walls	1	3	0	0	2	0	0	1
Ditto, additions or repairs to old work when the quantity in one building is under 900 ft. cube, extra [illegible]		—		0	2	0	0	1
[illegible]		—		0	3	3	0	1½
[illegible] including bonding	1	8	3	0	2	6	0	1
Ditto, chimney shafts, under 20 ft. above [illegible]	1	17	0	0	3	3	0	1½
[illegible]	1	5	0	0	2	3	0	1
[illegible] radius	1	14	0	0	3	0	0	1½
Ditto, when brickwork is worked fair both sides	0	5	0	0	0	6	0	0¼
Old brickwork in lime mortar, taken down, cleaned and stacked, including scaffolding	2	0	0	0	4	0	0	1¾
Ditto, in cement mortar ditto	3	0	0	0	6	0	0	2¾
Ditto in lime mortar without scaffolding	1	15	0	0	3	0	0	1¼
Ditto in cement mortar, ditto	2	9	0	0	4	4	0	2

Comparative Value of Brickwork.

(According to rate per Foot Cube)

Price per Foot Cube	Price per Yard Cube			Price per Rod			Price per Foot Cube	Price per Yard Cube			Price per Rod		
d	£	*s*	*d*	£	*s*	*d*	*d*	£	*s*	*d*	£	*s*	*d*
1	0	2	3	1	5	6	10	1	2	6	12	15	2¼
¼	0	2	10	1	11	11	¼	1	3	1	13	1	7
½	0	3	4½	1	18	3	½	1	3	7½	13	7	11½
¾	0	3	11	2	4	8	¾	1	4	2	13	14	4
2	0	4	6	2	11	0¼	11	1	4	9	14	0	9
¼	0	5	1	2	17	5	¼	1	5	4	14	7	1
½	0	5	7½	3	3	0¼	½	1	5	10½	14	13	6
¾	0	6	2	3	10	2	¾	1	6	5	14	19	10½
3	0	6	9	3	16	7	12	1	7	0	15	6	8
¼	0	7	4	4	2	11	¼	1	7	7	15	12	7½
½	0	7	10½	4	9	4	½	1	8	1½	15	19	0
¾	0	8	5	4	15	8½	¾	1	8	8	16	5	4½
4	0	9	0	5	2	1	13	1	9	3	16	11	9
¼	0	9	7	5	8	5½	¼	1	9	10	16	18	2
½	0	10	1½	5	14	10	½	1	10	4½	17	4	6
¾	0	10	8	6	1	2½	¾	1	10	11	17	10	11
5	0	11	3	6	7	7	14	1	11	6	17	17	3½
¼	0	11	10	6	14	0	¼	1	12	1	18	3	8
½	0	12	4½	7	0	4	½	1	12	7½	18	10	0½
¾	0	12	11	7	6	9	¾	1	13	2	18	16	5
6	0	13	6	7	13	1½	15	1	13	9	19	2	10
¼	0	14	1	7	19	6	¼	1	14	4	19	9	2
½	0	14	7½	8	5	10½	½	1	14	10½	19	15	7
¾	0	15	2	8	12	3	¾	1	15	5	20	1	11½
7	0	15	9	8	18	8	16	1	16	0	20	8	4
¼	0	16	4	9	5	0	¼	1	16	7	20	14	8½
½	0	16	10½	9	11	5	½	1	17	1½	21	1	1
¾	0	17	5	9	17	9½	¾	1	17	8	21	7	6
8	0	18	0	10	4	2	17	1	18	3	21	13	10
¼	0	18	7	10	10	6½	¼	1	18	10	22	0	3
½	0	19	1½	10	16	11	½	1	19	4½	22	6	7
¾	0	19	8	11	3	4	¾	1	19	11	22	13	0
9	1	0	3	11	9	8	18	2	0	6	22	19	4½
¼	1	0	10	11	16	1	19	2	2	9	24	4	11
½	1	1	4½	12	2	5	20	2	5	0	25	10	5
¾	1	1	11	12	8	10	21	2	7	3	26	15	11

Facings, &c

(Extra only to the foregoing Brickwork)

		s	*d*
	sup	0	1½
	,,	0	3
	,,	0	3¼
	,,	0	2¼
	,,	0	4

FACINGS &c.—*continued*		s	d
	per ft sup	0	4
		0	5½
		0	6
		0	7
		2	2
		1	3
		1	4
		3	6
		0	0½
mortar		0	1
Add if brickwork has battered face		0	1½
Add if brickwork curved on plan under 50 ft radius	„	0	1½
Internal facings of picked stocks and jointed fair for limewhiting	„	0	1
Joints of brickwork struck fair only for inside work as limewhiting	per yd sup	0	4
White glazed tiles 6 in × 6 in, 6 in × 3 in or			
		13	0
	per ft run	0	3
		0	5
	„	0	4
	„	0	1

ARCHES

(Face and soffit to be measured.)

		s	d
Extra only on common brickwork for rubbed and			
	per ft sup	2	2
	„	0	7
Ditto for rough axed arches in stocks, including	„	0	6
	„	1	0
	„	2	6
	„	2	0
	each	2	4
	per ft sup	0	9

CORNICES

per ft.

Comparative Value of Brickwork

(According to rate per Foot Cube)

Price per Foot Cube	Price per Yard Cube			Price per Rod			Price per Foot Cube	Price per Yard Cube			Price per Rod		
d	£	s	d	£	s	d	d	£	s	d	£	s	d
1	0	2	3	1	5	6	10	1	2	6	12	15	2½
¼	0	2	10	1	11	11	¼	1	3	1	13	1	7
½	0	3	4½	1	18	3	½	1	3	7½	13	7	11½
¾	0	3	11	2	4	8	¾	1	4	2	13	14	4
2	0	4	6	2	11	0½	11	1	4	9	14	0	9
¼	0	5	1	2	17	5	¼	1	5	4	14	7	1
½	0	5	7½	3	8	9½	½	1	5	10½	14	13	6
¾	0	6	2	3	10	2	¾	1	6	5	14	19	10½
3	0	6	9	3	16	7	12	1	7	0	15	6	3
¼	0	7	4	4	2	11	¼	1	7	7	15	12	7½
½	0	7	10½	4	9	4	½	1	8	1½	15	19	0
¾	0	8	5	4	15	8½	¾	1	8	8	16	5	4½
4	0	9	0	5	2	1	13	1	9	3	16	11	9
¼	0	9	7	5	8	5½	¼	1	9	10	16	18	2
½	0	10	1½	5	14	10	½	1	10	4½	17	4	6
¾	0	10	8	6	1	2½	¾	1	10	11	17	10	11
5	0	11	3	6	7	7	14	1	11	6	17	17	3½
¼	0	11	10	6	14	0	¼	1	12	1	18	3	8
½	0	12	4½	7	0	4	½	1	12	7½	18	10	0½
¾	0	12	11	7	6	9	¾	1	13	2	18	16	5
6	0	13	6	7	13	1½	15	1	13	9	19	2	10
¼	0	14	1	7	19	6	¼	1	14	4	19	9	2
½	0	14	7½	8	5	10½	½	1	14	10½	19	15	7
¾	0	15	2	8	12	3	¾	1	15	5	20	1	11½
7	0	15	9	8	18	8	16	1	16	0	20	8	4
¼	0	16	4	9	5	0	¼	1	16	7	20	14	8½
½	0	16	10½	9	11	5	½	1	17	1½	21	1	1
¾	0	17	5	9	17	9½	¾	1	17	8	21	7	6
8	0	18	0	10	4	2	17	1	18	3	21	13	10
¼	0	18	7	10	10	6½	¼	1	18	10	22	0	3
½	0	19	1½	10	16	11	½	1	19	4½	22	6	7
¾	0	19	8	11	3	4	¾	1	19	11	22	13	0
9	1	0	3	11	9	8	18	2	0	6	22	19	4½
¼	1	0	10	11	16	1	19	2	2	9	24	4	11
½	1	1	4½	12	2	5	20	2	5	0	25	10	5
¾	1	1	11	12	8	10	21	2	7	3	26	15	11

Facings &c

(Extra only to the foregoing Brickwork)

		s	d
	sup	0	1½
		0	3
		0	3½
		0	2½
		0	4

FACINGS, &c —*continued*

		s	d
	per ft sup	0	4
	,,	0	5½
	,,	0	6
	,,	0	7
	,,	2	2
	,,	1	8
	,,	1	4
	,,	3	6
height	,,	0	0½
Add if facing bricks are laid and jointed in coal ash mortar	,,	0	1
Add if brickwork has battered face	,,	0	1½
Add if brickwork curved on plan, under 50 ft radius	,,	0	1½
Internal [illegible]	,,	0	1
	per yd sup.	0	4
	,,	13	0
	per ft run	0	3
	,,	0	5
	,,	0	4
	,,	0	1

ARCHES

(Face and soffit to be measured)

		s	d
Extra only on common brickwork for rubbed and	per ft sup.	2	2
addition	,,	0	7
Ditto for rough axed arches [illegible]	,,	0	6
	,,	1	0
	,,	2	6
	,,	2	0
	each	2	4
	per ft. sup	0	9

CORNICES

		s	d
	per ft sup	0	2

Cornices—continued

		s	d
Ditto with brick dentils or dog s tooth, set close,	per ft sup	0	3
	per ft run	0	1½
	,,	0	2
gauged plain course	,,	0	4
Add for each additional course, ditto	,,	0	5
Oversail at eaves, red brick moulded rubbed and gauged course	,,	0	6
Add for each additional course ditto	,,	0	6
Extra on common brickwork for plain moulded course	,,	0	3
Mitres external or internal, to plain courses	each	0	1½
Ditto, ditto, to moulded courses, plain	,,	0	2
Ditto ditto, ditto rubbed and gauged	,,	0	4

Copings

		s	d
Two courses of best Broseley tiles laid in cement and both edges pointed with cement	per ft sup	0	8
Brick on edge coping in cement, flat measure the brickwork and facings being measured in addition, materials and labour	,,	0	1½
Double chamfered or double bull nose red brick	per ft run	0	9
	,,	1	3
	,,	0	10
	,,	1	4
Stock brick on edge coping Broseley double tile creasing and cement fillets both sides to 1 brick walls	,,	0	10
Hard red brick ditto, ditto	,,	1	0
Extra for forming cut mitred angles, intersections, &c to ditto	each	0	2
Jennings improved vitrified glazed stoneware coping for 1 brick walls set and jointed in cement	per ft run	1	6
Angles returns, or stopped ends to ditto	each	5	3
Take off clear away old coping and double tile creasing to 1 brick walls and prepare wall for setting new coping	per ft run	0	2
Broken glass bottling on 1½ in thick Portland cement bed to 1 brick walls	,,	0	5

Plinth and Moulded Courses, &c

Plinth Stretcher

		s	d
Extra only for splayed brick plinth course stretchers 2¼ in projection (the cubic quantity being measured as brickwork) and also the facings and pointings in addition	per ft run	0	4
Extra only for angles to ditto	each	0	5
Extra only for splayed or bull nose angle straight (and ditto)	per ft run	0	2
Stops or mitres to ditto	each	0	3
Extra only for moulded bricks straight (and ditto)	per ft sup	1	0
Stops or mitres to ditto	per inch run	0	1

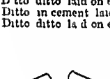
Damp proof Courses

		s	d
½ in Val de Travers asphalte damp course	per yd sup	3	9
¾ in to ⅞ in vertical ditto		5	6
Callendar s pure bitumen damp course including lapping (pieces 24 ft long up to 3 ft wide)	per ft sup	0	3
¾ in Limmer asphalte horizontal damp course laid by company s own workmen		0	6
⅝ in ditto vertical keyed into joints of brickwork		0	9
Ruberoid patent damp course		0	3
1½-in. vitrified glazed stoneware damp proof or continuous air course to suit thickness of walls and bedded in cement		1	2
		1	6
	each	0	8
		1	0
and laid in cement	per ft sup	0	7
Levelling and preparing brick walls for damp course		0	1
Pointing to edge of slate or asphalte damp course	per ft run	0	1½

Brick Nogging

Stock brick nogging in lime mortar laid flat (quarters measured in)	per yd sup	4	6
Ditto ditto laid on edge (ditto)		3	6
Ditto in cement laid flat (ditto)		5	3
Ditto ditto laid on edge (ditto)		4	0

Fire work



Fire Cheeks

Fireclay grate or range cheeks 8 in × 8 in × 2 in	per pair	2	0
Setting only grates and stoves 30 in to 40 in wide materials and labour	each	8	0
Ditto self contained small stoves ditto		5	0
Ditto ranges with ovens boilers and feed cistern ditto up to 4 ft wide		30	0
Ditto kitcheners complete 4 ft to 6 ft wide ditto		60	0
Fixing cast iron slate marble or stone chimney pieces		3	0
Brickwork to coppers boilers ovens &c in grey stocks set with fine mortar including cuttings and fixing ironwork	per ft cube	1	4
Ditto including Stourbridge fire brick linings to flues and fire set in fireclay		2	0
	per ft sup	1	6
	per ft run	1	8

FIRE WORK—*continued*

		s	d
	per lb	1	6
	per gal	0	7
	each	2	9
ted	„	5	0

POINTING

		s	d
Pointing new work flat struck joint in lime mortar	per yd sup	1	5
Ditto ditto in coal ash or blue lias	„	1	8
Ditto ditto in cement mortar	„	1	10
Add to foregoing items if in soffits of arches, or in chimney shafts	„	0	2½
Raking and pointing with cement mortar to lead flashings	per ft run	0	1½
	„	0	2
	„	0	0½
	„	0	1
		0	2½
	„	0	3½
Raking out and pointing joint round frames with stone lime mortar	per yd run	0	2
Ditto ditto with coal ash mortar	„	0	3
Ditto ditto with cement mortar	„	0	4

BEDDING

		s	d
Level and prepare old walls to receive new work	per ft sup	0	1½
Bedding corrugated iron on walls and pointing both sides in cement	„	0	3
		0	4
	per yd run	0	2½
		0	3
		0	3½
	each	1	9
	„	2	3
Bedding window boards in mortar and pointing round	„	0	6
Making good to window sills bedded up and pointed with lime mortar		1	0
Bedding wall plates in lime mortar on new walls	per ft run	0	1½
Ditto in cement on new walls	„	0	2
Ditto in pitch and tar on new walls	„	0	1½

CUTTING AND PINNING

		s	d
Rough cutting and waste straight for gables skew backs &c	per ft sup	0	2
Ditto circular over or under arches		0	2½
	per ft run	0	1
	„	0	2
	„	0	1½
	„	0	4
Cut for and pin edges of 3 in landings in cement	„	0	4½
Ditto 4 in ditto	„	0	5½
Ditto 6-in ditto	„	0	7

Cutting and Pinning—*continued*

		s	d
Fair cutting and rubbing face work, straight	per ft sup	0	4
Ditto, ditto, circular	,,	0	6
	per ft run	0	2½
	,,	0	3
	,,	0	9
	each	0	2
	,,	0	3
in lime mortar	per ft sup	0	5½
Ditto, ditto in cement	,,	0	6½
	per ft cube	0	5
	,,	0	9
	,,	0	11
Ditto ditto in cement	,,	1	2
Cut in brick walls for ends of solid steps and sills	each	0	9
	,,	0	6
	,,	0	8
	,,	1	0
	per in deep	0	1½
		0	3½
	,,	0	0½
		0	1
		0	1½

Paving

Forming ground or concrete foundation paid for in addition

Description	Straight				Herring Bone or Diagonal			
	Flat.		On Edge		Flat.		On Edge	
	s	d	s	d	s	d	s	d
Hard stock paving bricks laid and jointed with cement per yd sup	4	2	5	8	4	6	6	0
Vitrified blue Staffordshire panel paving bricks with bevelled edges and ditto ,,	7	2	—		—		—	
Ditto square edged and ditto ,,	6	6	9	0	6	10	9	6
Candy's buff vitrified stable paving bricks and ditto ,,	6	10	—		7	2	—	
Staffordshire quarries 6 in × 6 in two colours and ditto	6	2	—		6	8	—	

PAVING—*continued*

Description		Straight Flat	Straight On Edge	Herring Bone or Diagonal Flat	Herring Bone or Diagonal On Edge
		s d	s d	s d	s d
Best pressed or tesselated tiles, 6 in × 6 in, two colours, laid square, and ditto	per yd sup	10 0	—	10 6	—
Ditto, 4 in × 4 in and ditto	,,	11 0	—	11 6	—
Best glazed hearth tiles, 3 in × 3 in, without pattern any colour and ditto	,	13 0	—	20 0	—
Cement and labour only (exclusive of profit) in laying and jointing stock bricks	,,	2 4	3 0	2 6	3 3
Ditto blue Staffordshire	,,	2 3	3 0	2 6	3 3
Ditto Candy's vitrified bricks	,,	2 4	—	2 6	—
Ditto 6 in × 6 in tiles	,,	2 4	—	—	
Ditto 4 in × 4 in tiles	,,	2 9	—	—	—
Ditto 3 in × 3 in hearth tiles	,,	4 0	—	—	—
Take up flat or brick on edge paving, and clearing away under 50 yds	,	0 5	0 7	0 5	0 7
Ditto tiling as above	,	0 5	—	0 5	—
Straight or bevelled cutting includ					
	,	0 2	0 3	0 2	0 3
		0 3	0 4	0 3	0 4
		0 2	—	0 2	—
Forming channels in stock brick paving, including cutting and waste extra only	,,	0 4	0 6	0 4	0 6
Ditto in blue Staffordshire	,,	0 6	0 9	0 6	0 9

		s d
Terrazzo or Venetian mosaic paving of small marble cubes on cement bed then rolled and rubbed laid complete plain patterns	per yd sup	10 0
Ditto ditto ditto ornamental patterns	,,	20 0
4 in cement concrete bed 1 to 5 for laying paving on	,,	2 6
6 in ditto, ditto ditto	,	3 6
	,,	1 6
	,	1 9
	per ft run	0 3
	,,	0 5

TERRA COTTA

		s d
Terra cotta supplied only, manufacturer's general price including models	per ft cub	5 0
Hoisting and setting including filling hollow spaces with fine cement concrete		1 0

Terra cotta—*continued.*

		s	d
Moulded terra-cotta and setting in lime mortar	per ft cub	6	0
Enriched ditto, ditto, ditto	,,	10	0
Ordinary moulded cornices, 18 in × 12 in, supplied only	per ft run	7	0
Enriched frieze to ditto, 9 in × 6 in, supplied only	,,	2	6
Moulded string courses, 9 in × 8 in. ,,	,,	2	0
Enriched ditto, 9 in × 6 in ,,	,,	3	0
Moulded capping, 8 in × 5 in ,,	,,	1	3
Moulded bases 7 in × 7 in ,,	,,	1	0
Copings, weathered and twice throated, 12 in × 4 in, supplied only	,,	1	6

Miscellaneous.

[illegible]	per ft cube	1	7
	per ft sup	0	6
[illegible]			
	per yd run	0	2
	,,	0	0½
	per ft run	0	6
	,,	0	5
	,,	0	2
	,,	0	1
	each	1	8
[illegible]	,,	5	7
	,,	1	5
	,,	1	4
	,,	2	0
	,,	1	9
,,	,,	0	2
drains and pipes	,,	1	0
Building in only Arnott's, Boyle's, or other wall ventilators and making good	,,	1	0
,, dampers and frames, and making good in cement	,,	1	8
,, foot scrapers and ditto	,,	0	10
,, covers and frames for manholes, and ditto	,,	3	0
,, mangers, including brackets, and ditto	,,	2	6
,, brackets, projecting under 12 in, and ditto	,,	1	0
,, soot doors and ditto	,,	1	3
,, joists and ironwork for floors, &c	per cwt	2	0
Limewashing on walls, &c, 1 coat	per yd sup	0	1½
Ditto, 2 coats	,,	0	2½

Materials

(WITHOUT PROFIT)

Air bricks, glazed stoneware, or terra cotta, 9 in × 3 in on face	per 100	35	0
Air bricks, glazed stoneware, or terra cotta, 9 in × 6 in on face	,,	75	0

MATERIALS—*continued*

		s	d
Ashes coal sifted	per bushel	0	3½
smith's forge		0	4
for ash mortar from London railway stations	per ton	4	6
Ballast Thames	per yd cube	5	6
Bricks delivered sound hard grey stocks	per 1 000	34	0
rough stocks and grizzles		3[illegible]	0
shippers		4[illegible]	0
picked stocks for facings		54	0
Flettons		33	0
red wire cuts		40	0
gaults No 3 wire cut		50	0
kiln burnt red of uniform colour		60	0
best Fareham red		80	0
best red pressed Ruabon facing		105	0
facing red Cherry No 5 pressed T L B		83	0
best cutters or rubbers		1[illegible]0	0
red moulded bricks		90	0
best vitrified blue Staffordshire		90	0
bullnose		96	0
plinth		85	0
vitrified blue Stafford lure 8 panel paving		104	0
Candy's buff vitrified stable paving square		105	0
ditto ditto in tred		116	0
best Stourbridge firebricks		90	0
best Welsh		90	0
best Newcastle		80	0
best white glazed stretchers		230	0
headers		220	0
quoins bullnose		300	0
double stretchers		340	0
double headers		280	0
one side and two ends square		360	0
two sides and one end square		350	0
splays chamfered		330	0
for second quality glazed bricks			
		30	0
ding			
		5	0
		1	0
	per bushel	1	6
Roman		1	9
Chalk in small or large lumps	per yd cube	7	0
Coke breeze (8s per ton)		3	6
Chimney pots terra cotta or stone ware 30 in high plain	each	3	6
Ditto ditto ditto 24 in high plain		2	9
Damp course continuous vitrified glazed stoneware —			
4½ in wide × 1 in thick	per ft run	0	2½
9 in 1 in		0	4½

MATERIALS—*continued*

		s	d.
	—*continued*		
	per ft run	0	6¾
	,,	0	8
	,,	0	9
	,,	0	3
	,,	0	5½
	,,	0	8
	,,	0	9½
	,,	0	10½
9 in × 9 in × 1 in angles	each	0	9
14 in × 9 in × 1 in ,,	,,	1	0
9 in × 9 in × 1½ in ,,	,,	1	0
14 in × 9 in × 1½ in ,,	,,	1	4
Fire clay, Stourbridge, in sacks at railway depôt	per ton	27	0
,, ,,	per bushel	3	0
Galvanised iron ties, 9 in long, for hollow walls (247 per cwt — 7¼ ozs each	per cwt	31	9
Galvanised iron ties 9 in long, for hollow walls, same as last	each	0	1½
"Warrington" galv iron wall ties, 8½ in × ¾ in × ⅛ in, for 2½ in air cavity	per 100	12	6
Hair, bullock's, for mortar or plastering (1½ lbs per f c)	per cwt	9	0
Jennings' patent vitrified stoneware bonding bricks	per 100	16	0
	per ft run	1	4
	each	2	6
	per bushel	0	9
,, ,, ,, ,,	per y c of 16 bushels	12	0
,, ,, ,, lias, Aberthaw	per bushel	0	10
,, ,, ,, ,, ,,	per yd cube	17	0
,, ,, ,, white chalk	per bushel	0	7½
Lime mortar hand made, fine stuff	per ft cube	0	9¼
,, ,, ,, grey lime, plain (16s 7d y c)		0	7¼
,, ,, ,, ,, hair (18s 6d ,,)		0	8¼
,, ,, ,, hydraulic lime plain		0	11
,, ,, machine made plain (13s 3d y c)		0	6
,, ,, ,, ,, hair (14s 4d y c)		0	6½
Portland cement mortar hand made neat (45s 1d y c)		1	8
,, ,, ,, 1 to 1 (31s 5d ,,)		1	2
,, 1 to 2 (26s 2d ,,)		0	11½
,, 1 to 3 (23s 9d ,,)		0	10½
,, 1 to 4 (20s 4d ,,)		0	9
Partition slabs, the Mack, 6 ft × 12 in × 2 in	per yd sup	2	6
,, ,, ,, 2½ in		2	9
,, 4 in		4	0
Paving tiles, plain red square, 12 in × 12 in	per 100	30	0
,, ,, ,, 10 in × 10 in		23	0
,, ,, ,, 9 in × 9 in		20	0
,, ,, ,, 6 in × 6 in		12	0
,, ,, 4 in × 4 in		7	0
,, Staffordshire quarries in two colours 6 in × 6 in	,,	8	0

Wall Tie

MATERIALS—continued

		s	d
Paving tiles best pressed or tesselated 6 in × 6 in	per 100	24	0
4 in × 4 in		12	0
"	per yd cube	4	6
		1	6
		5	0
		7	0
hand washed		13	6
" hand washing labour only		1	9
Wall tiles white glazed 6 in × 6 in × ⅜ in	per 100	20	0
6 in × 3 in × ⅜ in		15	0
4½ in × 3 in × ¼ in		10	0
Water clean fresh including delivery under one mile	per ton of 224 gals	3	6
Water charge as supplied by the Metropolitan Water Board	per rod of brickwork	1	6

WAGES

		s	d
Wages bricklayer	per hour	0	10½
bricklayer's labourer		0	7
scaffolder		0	7½
carter or driver		0	6½
general labourer		0	7

ANALYSIS

MORTAR

Water for Slaking—The amount of water required for slaking different limes and cements is variable according to their freshness The following may be taken as approximate —

Description	Gal per ft cube	Gals per bushel
Pure or fat lime	6	7½
Plymouth stone lime	5	6
Grey chalk lime	4	5
Keynsham lias lime	2½	3
Lyme Regis lias lime	1½	2
Roman cement	3	3½
Portland cement	1½	2

Shrinkage As already pointed out when dealing with concrete lime and sand and cement and sand will shrink when mixed with water and made into mortar Cement shrinks 10 per cent when wetted and sand 20 per cent cement and sand in equal proportions 19 per cent This *reduction in bulk for lime and sand when mixed together* and wetted may be taken at ¼ or 25 per cent and for cement and sand at ⅙ or 17 per cent Sometimes the diminution in bulk is as much as ⅓ It varies

however, according to the freshness of the lime and cement, the coarseness of the sand, the proportions, as well as the amount of water used A pure lime absorbs more water than one with hydraulic properties, as it evolves greater heat and expands more in slaking, and a recently-burnt lime takes up more water than one that has been allowed to get stale The quantity generally needed is between $\frac{1}{3}$ and $\frac{1}{2}$ of the bulk of lime, but it is also affected by the sand Therefore extra quantities of materials, equal to this shrinkage, must be added to produce the stated quantity of mortar

MATERIALS FOR MORTAR PER YARD CUBE

Description	Lime	Cement	Sand	Water	Labourer
	Bush F C	Bush F C	Ft Cube	Gals	Hours
Lime mortar, 1 to 2	9 = 11	—	23	65	7
" , 1 to 3	7 = 9	—	27	50	7
Cement mortar, neat	—	24 = 30	—	65	15
" , 1 to 1	—	13 = 16	16	52	13
1 to 2	—	$8\frac{1}{2}$ = 11	22	40	13
, 1 to 3	—	$6\frac{1}{2}$ = 8	24	37	13
, 1 to 4	—	5 = 6	24	42	11
, , 1 to 5	—	4 = 5	25	43	11

Water for concrete, mortar, brickwork, &c, is usually included in the item of "Water for the Works," under the heading of Preliminary and Provisions, but is hereafter shown separately for better analysis

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always
slaked

at the time of measurement, as the difference in bulk is something like 50 per cent If measured with slaked lime the proportion would be 1 to 3, but if with unslaked or lump lime about 1 to 5 When the lime is lumpy (being delivered on site direct from kiln) the measure is not properly filled, and when the lime is slaked the measure is filled, but the lime has expanded in slaking For water allow $1\frac{1}{2}d$ per 25 gallons, same rate as for concrete

	s	d
[illegible]	5	3
	7	0
	0	3
	4	1
Price per yard cube (**hand made**)	16	7

The price per foot cube would therefore be 16*s* 7*d* ÷ 27 = 7½*d*

Hair Mortar —Hair mortar is required for bedding and pointing sash and door frames, filleting &c , and also for plastering Plain mortar is that without hair, or coal ash, &c , b [illegible]

a [illegible] of hair to the yard cube of mortar The extra cost would be the addition of the hair and the little further labour needed for its thorough incorporation with the whole mass Haired grey lime mortar, 1 to 3 —

	s	d
7 bushels of grey lime at 9*d*	5	3
27 f c 1 yard cube of sand at 7*s*	7	0
9 lbs of hair at 9*s* 6*d* per cwt	0	9
50 gals water at 1½*d* per 25 gal	0	3
Labour 9 hours at 7*d*	5	3
Price per yard cube (**hand made**)	18	6

And price per foot cube 18*s* 6*d* ÷ 27 = 8¼*d*

Cement Mortar —For cement mortar, 1 to 3 a common proportion the detail would appear —

	s	d
6½ bushels of Portland cement at 1*s* 6*d*	9	9
24 f c [illegible] yard cube of sand at 7*s*	6	3
37 gals water at 1½*d* per 25 gals	0	2
Labour 13 hours labourer at 7*d*	7	7
Price per yard cube (**hand made**)	23	9

Price per foot cube 23*s* 9*d* ÷ 27 = 10½*d*

Machine made Mortar —A steam mortar mill, with 6 ft pan and 10 h p engine will turn out per day of 9 hours 30 yds cube of ordinary lime mortar and 20 yds of hair mortar, actual quantities done Coals 3½ cwt , and one

driver and two assistant labourers attending The mixing for the former would therefore show —

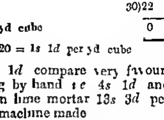
	s	d
Coals 3½ cwt at 20s per ton	3	6
One engine driver 9 hrs at 11d	8	3
Two assistant labourers 18 hrs at 7d	10	6
	30)22	3
Mixing only ordinary lime mortar per yd cube	0	9

And for hair mortar 22s 3d − 20 = 1s 1d per yd cube

These amounts of 9d and 1s 1d compare very favourably with the amounts for mixing by hand *i e* 4s 1d and 5s 3d respectively making plain lime mortar 13s 3d per y c and hair mortar 14s 4d if machine made

The grinding of brick rubbish with the mortar cheapens ities of old

when the quantity required amounts to more than 10 yds cube per day Machine made mortar is then much cheaper, and more thoroughly mixed than hand made mortar


Mortar Mill

Mortar mills are of three different classes (1) mills driven from below (2) mills driven from above and (3) mills with stationary pans They are made of different sizes with pans varying from 4 to 9 ft diameter and worked by horse steam or electric power Cost of mill with engine £100 to £200

BRICKWORK

Mortar —London stocks are 8¾ in × 4¼ in × 2¾ in and the usual specification is that no four courses including four mortar joints shall gauge more than 1 in in addition to the thickness of the bricks themselves This means ¼ in joints and gives 20¼ cubic inches of mortar per brick And 4 400 bricks × 20¼ cubic inches = 51½ ft cube, or say 2 yards cube of mortar per rod

With ⅜ in joints half as much more would be required = 77 ft cube or say 3 yards cube of mortar per rod

The above quantities are on the assumption that there is mortar all round each brick, ignoring the facing portions

where there is none, and in thin walls there will be less bearing But the amounts given may be taken as ample averages for any thickness of walling, including waste.

Sometimes the lime, or cement, and sand are inserted as separate items when working out the cost of a rod of brickwork, but it is much simpler and better to work out the price of mortar first of all beforehand, and take 2 or 3 yards cube of it ready made, according as joints are ¼ in or ⅜ in

Bricks per Rod —Now a rod of brickwork = 16½ ft × 16½ ft × 1⅛ ft (1½ brick thick) = 306¼ ft cube, and the calculation with ¼ in joints would appear —

	in		in		in		
Size of brick only	8¾	×	4¼	×	2¾	=	102¼ cub in
Two half joints	¼		¼		¼		
Size with joints	9	×	4½	×	3	=	121½ cub in

And 1 728 cub in per ft cube − 121½ cub in per brick and joints = 14¼ bricks per ft cube × 306¼ ft cube per rod = 4 364 bricks per rod net with ¼ in joints + 1 per cent for waste = say 4,400 total working number

This small allowance for waste is sufficient, as there are flues and stone, and timber end spaces, &c , not deducted

When the joints are ⅜ in , there will be 4,010 bricks net, and 4,050 total working number per rod

The number of bricks per rod is variously given at 4,300, 4,350, 4,400, 4,450 4,500, but the foregoing shows the proper

bricks are placed on or journeys First, the haulage from the yard to the barge or railway wagon, second the canal or railway transit to town nearest the site, third, the cartage from the town to the job itself—in each case including loading and unloading Water carriage is cheapest by far Railway rates for bricks are for 4 ton, 5 ton, 6 ton, and 8 ton lots, and the greater the load the cheaper the rate per ton For instance, for Thomas Lawrence and Son's well known T L B bricks, the railway rate from Bracknell, Berkshire, to Nine Elms Station, London, is 3*s* 4*d* per ton on 4 ton loads, but only 2*s* 10*d* per ton on 8 ton loads The railway rate for bricks from the Midlands to London is 6*s* 3*d* for 5 ton lots, and the carriage for Flettons from Peterborough to King's Cross, London, is about 10*s* 6*d* per thousand London stocks weigh 3 tons per thousand.

cart and pick up and throw, it will take him twice as long or 600 bricks loaded per hour The carter packs the bricks in his cart as he receives them A customary charge for loading is 8*d* per thousand and sometimes 6*d* for large quantities but the driver must help Loading at Fareham piecework costs 4*d* per thousand This is managed by the carter and a brickworks labourer but 1*d* per thousand is added for every labourer extra who may have to assist if the distance between the stack of bricks and the cart is considerable Discharging and stacking bricks from a barge 2*s* 3*d* per thousand

Cartage —Unloading barge of bricks paying canal dues use of barrows and planks loading into carts and deliver and stack within 1 mile averages 5*s* per thousand according to landing place and 1*s* per thousand for each mile beyond A horse and cart will deliver about 1 500 bricks per mile per day a cart load = 500 bricks The expense of cartage is chiefly the loading and unloading the difference of a mile or so in the journey bearing only a small proportion Haulage by traction engine costs a uniform rate of 1*s* 6*d* per thousand per mile and is best for distances over 12 miles

Builder's Cart

If the price includes delivery it saves the builder trouble in arranging transit

Price of Bricks —The brick trade in London seems to be

ons
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stocks have ranged from 10*s* to 30*s* per thousand at the brickfields and from 30*s* to 50*s* per thousand delivered on the site For the new Government Offices erected 1904—7, in Parliament Street London 25 millions of Flettons were required and the price was under 27*s* per thousand *delivered on the site*, this must have meant the extraordinarily

low rate of about 10*s* per thousand into trucks at the brickyard

For the cost of brickmaking an authority gives the following charges per 1 000 common stocks —

	s	d
[illegible]	2	6
[illegible]	0	2
[illegible]	1	3
[illegible]	0	2
[illegible]	0	4
[illegible]	0	10
Slop moulding wheeling and wages of boys	4	6
Skintling	0	3
Stacking in clamp	1	3
Stripping clamp and loading	0	8
Interest rates repairs &c	2	0
Sand for moulds straw for hacks &c	1	0
Fuel soil	1	9
Breeze for burning 3 cwt at 6*d*	1	6
Firing	0	2
	18	4
Add 15 per cent profit for brickmaker	2	8
Price per 1 000 at brickfield	21	0

A fair price for freehold land suitable for brickmaking is £200 per acre Royalty for obtaining clay if land is not bought outright varies from 1*s* to 2*s* 9*d* per yd cube 2 yds cube of mild or sandy clay to 3 yds cube of strong clay will make 1 000 bricks = 500 to 330 bricks per y c 1 acre 1 foot deep does ¾ million bricks or 1 acre 1 yard deep 2 millions The maximum profitable depth for working the clay is 30 ft

	s	d
Price of stocks per 1 000 at brickfield	21	0
Canal or other carriage to Thames wharf	6	0
Unloading barge loading into carts, and deliver and stack within 1 mile	5	0
Carting an additional mile beyond first	1	0
Unloading on site of building	1	0
Cost per 1 000 delivered on job	34	0

To allow for variation in the price of bricks the cost per rod will vary 4*s* 5*d* (4,400 per rod) for every 1*s* difference

in the price per 1,000 of the bricks for this, 5*s* per rod is assumed to be sufficiently exact, as that includes profit

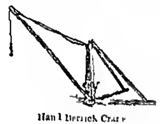
Water—Bricks absorb about $\frac{1}{5}$th or $\frac{1}{4}$th of their weight in water after 24 hours immersion This is equivalent to practically 1 pint per brick for absorption (1 gallon = 10 lbs, 8 pints = 1 gallon, and 1 pint = $1\frac{1}{4}$ lb), which is a ready guide for wetting allowance for bricks prior to laying As there are 4 400 bricks per rod, these will take up 4 400 pints of water, if the specification stipulates that the bricks shall be placed to soak in a tub for some time before setting Now 4,400 pints ÷ 8 pints per gallon = 550 gallons of water required per rod of brickwork If, however, the bricks are only to be sprinkled from a hose or a bucket, it is impossible to say how much water is likely to be used An allowance of 125 to 200 gallons has been stated, but this is really for making the mortar (2 to 3 yards cube per rod) The Metropolitan Water Board charges 1*s* 6*d* for water per rod of brickwork Although water is taken under the heading of "Water for the Works," it is shown separately in brickwork for the sake of better analysis

Labour per Rod—It was formerly considered that in foundations and walls where the joints were left rough, a bricklayer, supplied with materials by his labourer, could lay 1,500 bricks per day, as, owing to the mass of the work, he could pack them in with both hands In boundary and other walls where both faces have to be worked fair, not more than 1,000, and if they were carefully jointed and faced with picked bricks of a uniform colour, not more than 500 per diem, and then only in straight walling without many openings The time spent is less for thick walls, and greater for thin ones

A bricklayer and his labourer can still lay the above number if they choose, or say, for all ordinary purposes, 2 yards cube per day, comprising 780 bricks, but frequently not more than $1\frac{1}{2}$ yards cube, or 580 bricks, are reckoned. It is even estimated by experienced builders that a bricklayer nowadays only lays 500 inside and 300 facing bricks per day, which would be an average of 400 bricks over all the walling As there are 390 bricks in a cubic yard, this would be roughly, a cubic yard of brickwork per man per day In London, 450 bricks per day is considered a fair standard, and the unwritten trade union limit is supposed to be 400 The London County Council limit has been stated to be as low as 330 bricks per day It is, therefore, most perplexing to put down any reliable data for labour, but if

1¼ yards cube per day, or 680 bricks are taken (which *ought* to be done with good supervision), this would give 4,400 bricks per rod ÷ 680 bricks = 6½ days of bricklayer and his labourer per rod for ordinary 1½-brick walling More labour will be required if the brickwork is in cement mortar, and also if walls are 1 brick or ½ brick thick

For hodsmen or bricklayers' labourers, on ground floor allow 1 hodsman to 2 bricklayers (= ½ hodsman to 1 bricklayer), on upper floors, where hodsmen have to ascend and descend ladders, allow 1 hodsman to 1 bricklayer, and on chimneys, involving long up and down climbing, allow 2 hodsmen to 1 bricklayer This averages 1 hodsman to 1 bricklayer For large buildings it does not pay for bricklayers to be served by the old fashioned system of hod carriers, but by labour saving appliances such as barrow hoists, raising 20,000 bricks per hour, by improved scaffolding and platform lifts, one ascending while the other descends (one of these platforms can be raised from the ground at the rate of 10 ft per second) by mortar mills, concrete mixers and such like machines.



Hand Derrick Crane

By supplanting hodsmen by capstans and cranes, as much as £50 per week can be saved in the labour bill on extensive works

By the convenient arrangement of the materials on the scaffold floor so that the bricks will be on the left, and the mortar board on the right, of each man much time is saved in turning and lifting The periods spent in such necessary movements are considerably greater than that occupied in the actual laying of the brick A second saved in the placing of each of a million bricks (a common number in a large building) is 277 hours, and 277 hrs × 10½*d* per hr = £12 odd If a structure requires a million bricks, and five

ing of £61,

Similarly

l mortar, as

the latter is cheap and not so valuable as the motions

trowel, instead of by repeated hammering of the latter to

force the brick into place in stiff mortar By the use of soft mortar enough can be laid with one stretch of a large trowel for perhaps a dozen bricks These up to date methods were adopted in the erection of the Westinghouse buildings at Manchester, in 1901, with the result that on common work the average was over 2,000 bricks laid per man per day The American contractors (with British workmen and higher wages) actually accomplished in little more than one year a quantity of work which English builders said could not be completed in less than five years Also see Chapter III, section on Electricity in Building Operations *Verb sap*

Scaffolding—For the use of scaffolding erection, and removal, 6s per rod may be charged As a scaffolder gets $7\frac{1}{2}d$ per hour, this represents the erection, and removal on completion, of sufficient scaffolding for one rod in a day

DETAIL PER ROD

Brickwork in Lime Mortar, 1 to 3—The analysis of a rod of stock brickwork, standard thickness in grey chalk lime mortar, 1 to 3 with $\frac{1}{4}$ in joints, would then be —

	£	s	d
4 400 stocks at 34s per 1 000 delivered	7	9	7
Water for wetting bricks only, Metropolitan Water Board charge (say 550 gals)	0	1	6
	1	6	6
$1\frac{1}{2}$ *l*			
	4	5	4
	0	6	0
	13	8	11
Add 20 per cent profit &c	2	13	7
Total price per rod	16	2	6

The price per yard cube can easily be deduced from the foregoing by dividing £16 2s 6d by $11\frac{1}{3}$, the number of cubic yards per rod, which gives —

£16 2s 6d ÷ $11\frac{1}{3}$ = £1 8s 6d per yard cube

Similarly, the price per foot cube, by dividing the same sum by 306, the number of cubic feet per rod —

£16 2s 6d ÷ 306 = 1s $0\frac{1}{2}d$ per foot cube

The price per yard cube and per foot cube can, however, be detailed separately with proportionate reduction in materials and labour, but the larger the standard taken the less waste, and the closer will be the investigation

Brickwork in Cement Mortar, 1 to 3—For stock brick work in cement mortar, 1 to 3, standard thickness, with

¼ in joints as before, the valuation would be in like manner There will now be more labour, as cement works shorter

	£	s	d
4 400 stocks at 34s per 1 000 delivered	7	9	7
Water for wetting bricks only Metropolitan Water Board charge (say 550 gals)	0	1	6
2 yds cube cement mortar 1 to 3 at 23s 9d	2	7	6
Labour building 7½ days bricklayer and labourer at 13s 1½d	4	18	5
Use of scaffolding erection and removal	0	6	0
	15	3	0
Add 20 per cent profit &c	3	0	6
Total price per rod	18	3	6

Price per yard cube would be £18 3s 6d ÷ 11⅓ = £1 12s 1d
And price per foot cube would be £18 3s 6d ÷ 306 = 1s 2d

When brickwork is billed "extra only in cement" the price can readily be obtained by deducting the price of a rod of brickwork in mortar from a rod in cement

With these examples and memoranda before him, the estimator should be able to work out for himself other items where the proportions of lime or cement and sand are different and where there may be another size of brick

Hollow Walls —These are taken as solid, the 2½ in cavity being measured in the thickness The ties should be inserted at every 3 or 4 bricks in length and every 3 or 4 courses in

super ÷ 9 f s × 4) The ties may be either Jennings patent vitrified stoneware bonding bricks at 16s 6d per 100 if 9 in long or 9 in galvanised iron ties weighing 247 to the cwt at 31s 9d per cwt or 1½d each Allow for hay bands or wooden fillets to prevent the mortar from dropping into the hollow space—about 10s per rod For brickwork in lime mortar in hollow walls therefore—

	£	s	d
Materials and labour per rod as before prime cost	13	8	11
120 Jennings 9 in bonding bricks at 16s 6d per 100	0	19	10
Hay bands and shifting	0	10	0
	14	18	9
Deduct ⅙th of £13 8s 11d for 2½ in cavity (measured in with the brickwork)	2	4	10
	12	13	11
Add 20 per cent profit &c	2	10	9
Total price per rod	15	4	8

There is thus an apparent reduction of 18s per rod over solid walls, owing to the saving of brickwork in the cavity more than compensating for the ties and hay bands But as a little more labour would be required in building two skins of brickwork instead of a solid wall the price is usually reckoned the same

Add if in Backing to Masonry—This necessitates more labour and more rough cutting than ordinary brick walling For the former allow an additional half day of bricklayer and labourer For the latter take $\frac{1}{4}$ brick wasted per ft super and as there are 8 bricks per ft super facing English bond this gives 272 ft super rod $\times$ 8 bricks per ft super $\times$ $\frac{1}{4}$ brick wasted = say 500 bricks wasted per rod

	£	s	d
Additional labour $\frac{1}{2}$ day bricklayer and labourer at 13s $1\frac{1}{2}d$	0	6	7
Bricks wasted 500 at 34s per 1 000	0	17	0
	1	3	7
Add 20 per cent profit &c	0	4	8
Total price per rod	1	8	3

Price per yard cube £1 8s 3d ÷ $11\frac{1}{3}$ = 2s 6d
Price per foot cube £1 8s 3d ÷ 306 = 1d

Add if in Chimney Shafts—For ordinary chimney shafts under 20 ft above roof add to the price of general brickwork £1 17s per rod 3s 3d per yard cube or $1\frac{1}{2}d$ per foot cube

But for tall factory chimneys allow £8 to £12 per foot in height from surface of ground which includes everything—concrete foundations brick shaft firebrick lining iron cap and copper lightning conductor Brickwork best built in lime mortar which stands heat better than cement Diameter at ground line $\frac{1}{10}$ height

Add if in Circular Brickwork—If quick sweep or under 15 ft radius there will be $1\frac{1}{2}$ days additional labour per rod and about 5 per cent waste for the cutting required throughout the thickness of the wall

	£	s	d
Additional labour $1\frac{1}{2}$ days bricklayer and labourer at 13s $1\frac{1}{2}d$	0	19	8
Bricks wasted 5 per cent on 4 400 = say 250 bricks at 34s per 1 000	0	8	6
	1	8	2
Add 20 per cent profit &c	0	5	10
Total price per rod	1	14	0

Price per yard cube £1 14s ÷ $11\frac{1}{3}$ = 3s
Price per foot cube £1 14s ÷ 306 = $1\frac{1}{3}d$

Flat sweep or over 15 ft radius, would be half the above rates

Old Brickwork in Lime Mortar taken down—In demolishing old brickwork in lime mortar, without scaffolding including cleaning and stacking the bricks for re use, a labourer can pull down a rod, or 306 f c, in 50 hours Therefore —

	£	s	d
50 hrs labourer at 7*d*	1	9	2
Add 20 per cent profit &c	0	5	10
Total price per rod	1	15	0

Price per yard cube £1 15*s* ÷ 11⅓ = 3*s*
Price per foot cube £1 15*s* ÷ 306 = 1⅓*d*
Ditto in cement mortar 70 hrs labourer at 7*d* works out to £2 9*s* per rod with profit 4*s* 4*d* per y c = 2*d* per f c

Detail per Yard Cube

The following analyses per yard cube are given separately for the local convenience of many readers The mortar proportions taken are the common ones of 1 to 2 As there are 11⅓ yards cube in a rod the reduction in materials and labour will be about $\frac{1}{11}$th of those for a rod See preceding pages

Brickwork in Lime Mortar 1 to 2—The analysis of a yard cube of stock brickwork standard thickness, in grey chalk lime mortar 1 to 2 with ¼ in joints would then be —

	£	s	d
390 stocks at 34*s* per 1 000 delivered	0	13	3
Water for wetting bricks only (say 50 gals)	0	0	1½
⅙ yd cube lime mortar 1 to 2 at 13*s* 9*d*	0	2	3½
Labour building 5½ hrs bricklayer and labourer at 10½*d* and 7*d*	0	8	0
Use of scaffolding erection and removal	0	0	6
	1	4	2
Add 20 per cent profit &c	0	4	10
Total price per yard cube	1	9	0

And price per foot cube would be £1 9*s* ÷ 27 = 1*s* 0¾*d*

Brickwork in Cement Mortar 1 to 2—For stock brickwork in cement mortar, 1 to 2 standard thickness, with ¼ in joints as before the valuation is similar But there is more labour, as cement works stiffer

	£	s	d
	0	13	3
	0	0	1¼
	0	4	4½
rer, at 10½*d*	0	8	9
Use of scaffolding erection and removal	0	0	6
	1	7	0
Add 20 per cent profit &c	0	5	5
Total price per yard cube	1	12	5

And price per foot cube would be £1 12*s* 5*d* — 27 = 1*s* 2½*d*

Facings

Facings of best picked Stocks finished with a neatly struck Weathered Joint —There are 272 ft super in a rod and as 7 bricks go to the square foot, this gives 2 000 facing bricks per rod, with allowance for waste For picking, a labourer will take 3½ hours to select 1 000 bricks, or 7 hours to select the 2 000 facing bricks requisite per rod A bricklayer will occupy a day in striking the joints for the 1 000 bricks, or 2 days in striking the 2 000 facing bricks necessary per rod The labourer would attend remaining time *i e*, 2 days or 18 hrs — 7 hrs — 11 hrs

	s	d
	4	1
	3	0
	15	9
	6	5
	29	3
Add 20 per cent profit &c	5	10
Price per rod of 272 ft super	272)35	1
Price per foot super	0	1½

If *facing* instead of "picked" stocks are specified the

finished with a neatly struck Weathered Joint —Here there is extra for superior bricks and Thomas Lawrence and Son s Bracknell Red Cherry No 5 pressed facings cost 76*s* per thousand in 8 ton lots at Nine Elms, or say 83*s* delivered on site, as over The bricks weigh 2 tons 13 cwt per thousand,

and the railway rate is 2s 10d per ton on 8 ton loads Therefore 2s 10d × 2$\frac{1}{10}$ tons = 7s 6d, railway rate per thousand The 8 ton truck would thus contain 3 000 bricks

	s	d
	67	6
..	0	8
..	0	4
	7	6
Delivered at Nine Elms	76	0
Loading and unloading	1	0
Cartage 2 miles	6	0
Price delivered on site per 1 000	83	0

Then the detail for the item proper would appear —

	£	s	d
Cost of Cherry facing bricks per 1 000	4	3	0
Deduct cost of stocks per 1 000	1	14	0
Difference per 1 000	2	9	0

And as there are 7 facing bricks per foot super 272 × 7 = 1 900 per rod we now proceed —

		£	s	d
Cost of 1 900 bricks extra only at difference of £2 9s per 1 000		4	13	1
Material for jointing say 5 ft cube lime mortar at 7½d		0	3	0
Striking joints 2 days or 18 hours bricklayer at 10½d		0	15	9
		5	11	10
Add 20 per cent profit &c		1	2	4
Price of 272 ft super	272	6	14	2
Price per foot super		0	0	6

Facings of Glazed Bricks —These are 9 in × 4½ × 2$\frac{3}{4}$ in and weigh 3½ tons per thousand Railway rate for Leeds glazed bricks to London is 40s per thousand in 4 ton lots Cart load is 400 and London cartage 10s per thousand within usual limits Trade discount 10 to 15 per cent Second quality is 30s per thousand lower than first To prices of white glazed bricks—

Add 25 per cent for ordinary tints buff and cream
50 " superior colours reds and greens &c
100 " stock ornamental patterns on white or coloured ground

Joints of Brickwork struck fair only for Inside Work as Limewhiting —This is merely labour and can be done as the

work proceeds A bricklayer could do 30 yards per day, or, say, 1 yard in $\frac{1}{3}$ hour

	s	d
$\frac{1}{3}$ hour bricklayer at $10\frac{1}{2}d$	0	$3\frac{1}{2}$
Add profit	0	$0\frac{1}{2}$
Price per yard super	0	4

ARCHES

Extra only on common Brickwork for rubbed and gauged Arches in best red Rubbers, set in Cement and jointed in Putty —This is really extra on the facing bricks which have been already taken One foot super of gauged arch requires 10 bricks, including waste as against 7 bricks for facings

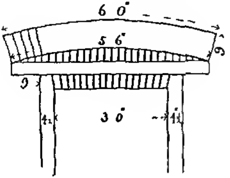
	s	d
Cost of 10 rubbers at 120s per 1 000	1	$2\frac{1}{2}$
Deduct cost of 7 facing bricks, at 20s per 1 000 extra only over stocks	0	$1\frac{3}{4}$
	1	$0\frac{3}{4}$
Cement and lime putty for setting and jointing	0	1
Labour in cutting rubbing and setting $\frac{3}{4}$ hour bricklayer at $10\frac{1}{2}d$	0	8
	1	$9\frac{3}{4}$
Add 20 per cent profit &c	0	$4\frac{1}{4}$
Price per foot super	2	2

Ditto for rough axed Arches in Stocks, cleaning and pointing —No special facing bricks are required and it is merely a matter of cutting and setting A bricklayer can turn and set in mortar including picking bricks a 9 in arch $4\frac{1}{2}$ in thick, comprising 15 stocks, over a 3 ft 6 in opening in an hour = 1 ft super in $\frac{1}{3}$ hour

	s	d
Mortar for pointing	0	$0\frac{1}{2}$
Axing and setting $\frac{1}{3}$ hour bricklayer at $10\frac{1}{2}d$	0	$3\frac{1}{2}$
Cleaning off and pointing	0	1
	0	5
Add 20 per cent profit &c	0	1
Price per foot super	0	6

Extra Labour Cutting and Waste to Relieving Arches — These are generally simply numbered, stating the size The

internal appearance of a 3 ft opening with a wooden lintel, would be as in sketch with dimensions as shown The arch is one brick deep by one brick wide (width of jamb) The rough cutting is the girth by width of arch, which gives the



Relieving Arch

axing required on the adjacent brickwork This axing is the extra labour involved for there is no additional trouble in building the arch itself which has been included in the ordinary walling

	s	d
6 0 extrados 5 6 intrados		
11 6 girth × 9 width of arch = 8⅝ ft super circular rough cutting and waste at 2½*d*	1	9
9 skewback 9 skewback		
1 6 length × 9 width of arch = 1 ft super straight rough cutting and waste at 2*d*	0	2
	1	11
Add 20 per cent profit &c	0	5
Total of each	2	4

Sometimes the rough cutting to skewbacks is taken separately

Half brick Trimmer Arch in Cement Mortar, including all Cuttings Materials, &c —There will be extra labour in building the arch as it is in ½ brick thickness and in small quantities The haunches will be levelled up with concrete to take the hearth above

	£	s	d
Price of rod of brickwork in cement mortar, 1 to 3	18	5	0
$\frac{£18\ 3s\ 6d}{272}$ = price of brickwork per foot super 1½ brick thick	0	1	4
$\frac{1s\ 4d}{3}$ — price of ditto ½ brick thick	0	0	5¼
Extra labour for ½ brick thick cutting and in small quantities	0	0	2
Levelling up with concrete in small quantities	0	0	1¾
Price per foot super	0	0	9

It will be observed that the above includes profit throughout

Moulded Course

Extra on Common Brickwork for Moulded Course —This is one course of red moulded brick measured extra only to common brickwork and the cubical contents of which have already been taken in the latter If header and stretcher be used alternately, allow two bricks per foot run The number will be a trifle less as one header and one stretcher with two joints, would measure 13½ in, but this extra length would allow for waste

	s	d
1 000 red moulded bricks at 90s	90	0
Deduct cost of 1 000 stocks at 34s	34	0
Difference	56	0
Therefore the cost extra only would show thus —		
2 bricks at 56s per 1 000	0	1¼
Extra cement	0	0¼
Extra labour in setting and pointing	0	0½
	0	2½
Add 20 per cent profit &c	0	0½
Price per foot run	0	3

Mitres to ditto —The mitred bricks cost double the price of the moulded ones and the detail would be worked out similarly

	s	d
1 000 mitred bricks at 180s	180	0
Deduct cost of 1 000 moulded bricks at 90s	90	0
Difference	90	0
1 mitred brick at 90s per 1 000	0	1¼
Add profit and extra setting	0	0¾
Price per mitre	0	2

All the labour and setting have already been included in the lineal dimension of the moulded course, as it is on this that the mitres are extra

Damp proof Courses

Damp proof Course of two Layers of stout Slates, breaking joint, and laid in Portland Cement—Countess or Duchess slates are generally used and second quality are the best for this class of work, as they are thicker and cheaper Slates are sold by the thousand of 1,200 delivered, and the area of a Countess slate would be 20 in × 10 in = $1\frac{1}{3}$ ft super , but allow one slate to the square foot, reckoning for waste in cutting to suit thickness of wall And as there are two layers there would be thus two slates per foot superficial for the damp course An inferior but good enough, sort for this purpose, could be got for £9 per 1,200 Sometimes special sized slates 14 in × 9 in, can be obtained to agree with thickness of brick walls

	s	d
2 slates at £9 per 1 200 delivered	0	$3\frac{1}{2}$
Cement for bedding	0	1
Labour cutting and laying	0	$1\frac{1}{2}$
	0	6
Add 20 per cent profit &c	0	1
Price per foot super	0	7

Fire work

Setting only Grates and Stoves, 30 in to 40 in wide—A bricklayer and labourer would take from two to three hours to set an ordinary grate, and some stock brickwork would probably be required for the backing, as well as fireclay for the fire lumps

	s	d
3 hours bricklayer ($10\frac{1}{2}d$) and labourer ($7d$) at 1s $5\frac{1}{2}d$	4	4
Brickwork say 2 ft cube at 1s 1d	2	2
Fireclay for fire lumps	0	2
	6	8
Add 20 per cent profit &c	1	4
Price of each	8	0

Ranges and kitcheners would cost a great deal more, depending upon the type of apparatus and the size of the opening, but 10s to 20s per ft run is not unusual

Pointing

Pointing new Work flat struck J [illegible]
This includes raking out joints, &c. [illegible]
require 5 ft cube of lime mortar, and [illegible]
Scaffolding would be already up and [illegible]

5 ft cube lime mortar at 7½d	[illegible]
Labour 10 hours bricklayer at 10½d	[illegible]
Add 20 per cent profit &c	[illegible]
Price per 10 yards super	[illegible]
Price per 1 yard super	[illegible]

Pointing is best given out as piece work [illegible]
men to execute as much as possible [illegible]
makes pointing a speciality is called a [illegible]
parts and will point, including raking out [illegible]

5 ft cube cement mortar 1 to 2 at 11 [illegible]	[illegible]
Labour 12 hours bricklayer at 10½ [illegible]	[illegible]
Add 20 per cent profit &c	[illegible]
Price per 10 yards super	[illegible]
Price per 1 yard super	1 10

In summer pointing to brickwork may be done as the work proceeds but in winter it should not be executed till the last when the walls are finished that is done downwards as the scaffolding is being removed in case of frost breaking it off

Tuck Pointing.—For material allow $\frac{1}{8}$ ft cube mortar and $\frac{1}{8}$ ft cube lime putty per yard super, and rather more than double the foregoing labour

Pointing Old Work.—If the pointing is to old work, a scaffold would have to be erected and removed, and there would also be some further time for raking out old joints, cleaning and rubbing down, &c, as compared with that in new work—about double the labour altogether

Raking and pointing with Cement Mortar to Lead Flashings.—The raking out is done by a labourer, who will do 100 ft run in 5 hours including supplying material, and the pointing by a bricklayer, who will execute 100 ft in 6 hours $\frac{1}{2}$ ft cube of cement mortar, 1 to 2, will point this length

	s	d
Labourer raking out 5 hours at 7*d*	2	11
Bricklayer pointing 6 hours at 10½*d*	5	3
Cement mortar 1 to 2 ½ ft cube at 11½*d*	0	6
	8	8
Add 20 per cent profit &c	1	9
Price of 100 ft run	100)10	5
Price per foot run	0	1¼

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joint steps would be about 1½ times the length of the straight raking line Consequently the price may be taken as 1½ times the last, that is 2*d* per ft run Add wedges as stated

Cement Filleting.—A bricklayer and labourer will run 10 ft per hour of 2½ in × ¾ in cement filleting under slating to gables using guiding laths Cement required, $\frac{1}{6}$ bushel per 10 ft run

	s	d
1 hour bricklayer and labourer	1	5½
⅙ bushel cement at 1s 6d	0	3
Guiding laths	0	1½
	1	10
Add 20 per cent profit &c	0	4
Price of 10 ft run	10)2	2
Price per foot run	0	2½

Bedding.

Bedding Frames in Hair Mortar, and Pointing with Cement. —This implies that the portion of the frame which abuts against the inner reveal is bedded in a narrow band of hair with 3 ft lding juire, say, ½ ft cube of mortar Labour would be about ¾ hour bricklayer and labourer.

	s	d
½ ft cube hair mortar for screeding at 8¼*d*	0	4
Cement for pointing all round	0	1¼
¾ hour bricklayer and labourer at 1s 5½*d*	1	1
	1	6¼
Add 20 per cent profit, &c	0	3¾
Price of 21 ft or 7 yds run	7)1	10
Price per yard run	0	3

Price 1s 9*d* per frame the item being sometimes thus billed

Bedding Wall plates in Mortar —A bricklayer, with attendant labourer, will bed about 24 ft run of 4½ in × 3 in wall plate per hour Area of bedding will be 24 ft × 4½ in = 9 ft super, requiring say, ½ ft cube of ordinary mortar

	s	d
½ ft cube of mortar at 7¼*d*	0	3½
1 hour bricklayer and labourer	1	5½
	1	9
Add 20 per cent profit &c	0	4
Price of 24 ft run	24)2	1
Price per foot run	0	1

Cutting and Pinning

Rough Cutting and Waste straight —This is for such parts as gables, skewbacks &c The waste is usually small and is mainly taken into consideration in the number of bricks allowed per rod of brickwork

	s	d
Waste in cutting say ¼ brick × 8 bricks affected per ft s	0	0¾
Labour in cutting $\frac{1}{10}$ hour bricklayer at 10½*d*	0	1
	0	1¾
Add 20 per cent profit &c	0	0¼
Price per foot super	0	2

Fair Cutting and Rubbing straight —Here more labour is entailed than in last while the waste is the same

	s	d
Waste in cutting say ¼ brick × 8 bricks affected per f s	0	0½
Labour in cutting and rubbing ¼ hour bricklayer at $10\frac{1}{2}d$	0	2¾
	0	3¼
Add 20 per cent profit &c	0	0¾
Price per foot super	0	4

Rough Cutting Skewback 5 in wide —This is cut after the work is built and generally refers to trimmer arches The skewback is 4½ in wide but is measured as 5 in The labour would be ⅙ hour of bricklayer at $10\frac{1}{2}d = 1\frac{3}{4}d + \frac{1}{4}d$ profit $= 2d$ per ft run

Cutting Groove —A bricklayer will cut about 10 ft run in an hour of grooving 1 in deep in brickwork for small pipe or as a raglet

	s	d
1 hour bricklayer	0	10½
Add 20 per cent profit &c	0	2
Price of 10 ft run	10)1	0½
Price per foot run	0	1¼

Rough Cutting for 4½ in × 4½ in Chase —This will probably apply to cutting a chase for a soil pipe but this is generally left as the work is carried up and is half a brick each way there would thus be little need to price it But if the pipe is small the chase would most likely be cut afterwards and would only mean a few minutes labour with hammer and chisel being estimated at about $4d$ per foot

If these should be the brickwork will have to be cut away for them For a 3 in landing one course of bricks will have to be removed and above this to 6 in two courses The lineal space above and below will then have to be made good and the edges of stone pointed with cement the mason will fix the landing For a 6 in landing (cutting out two courses) the detail would appear —

	s	d
Bricklayer ½ hour at $10\frac{1}{2}d$	0	5¼
Cement for making good and pointing	0	0½
	0	5¾
Add 20 per cent profit, &c	0	1¼
Price per foot run	0	7

For a 3 in landing (cutting out one course), take half the foregoing labour, making 4¼d per foot run for the whole cost Add 1d per foot run for every inch of increased thickness of landing

Cutting Toothings and Bonding New Brickwork to Old in Lime Mortar —One course in every four of the new brickwork would be toothed 4½ in into the old, which would be cut out to receive the projection The remaining three courses would make a straight joint The cost of the extra materials should be included with the labour For 1½ brick wall the detail would be —

	s	d
Extra brickwork 14 in × 3 in × 4½ in projection	0	1
Extra lime mortar for toothing	0	1
Labour, ¼ hour bricklayer at 10½d	0	2½
	0	4½
Add 20 per cent profit &c	0	1
Price per foot super	0	5½

If the toothings are in cement add 1d to foregoing rate

Cut for Ends of Steps and Pin in Cement —An item of this sort is on the assumption that owing to the great trouble and accuracy required in making provision before hand the holes for steps &c are cut away probably to a depth of 4½ in, and made good after the brickwork is up A bricklayer and labourer would be occupied about ⅓ hour over each one

	s	d
Labour ⅓ hour bricklayer and labourer at 1s 5¼d	0	5¾
Cement for pinning say	0	1¾
	0	7½
Add 20 per cent profit &c	0	1½
Price of each	0	9

Cutting and forming Holes to receive Ends of Timbers Girders, &c —Although these are described as cut for and pinned they are of course merely built in and pointed up as the work proceeds The area of end is not supposed to exceed 36 sq ins for small timbers and when above this the section should be stated Ends of joists are not included under this heading as they do not necessitate extra labour

	s	d
Labour, ¼ hour bricklayer and labourer at 1s 5½d	0	4¼
Cement for pinning say	0	1½
	0	5¾
Add 20 per cent profit &c	0	1¼
Price of each	0	7

And if we take the length inserted as resting 4½ in, then 7d ÷ 4½ in = 1½d per inch deep

Holes Cut for small Pipes, Bolts, &c—The price of this would vary according to the thickness of wall, the pipe being stated not to exceed 2 in diameter For a 1 brick wall, including making good, allow —

	s	d
Labour, ½ hour bricklayer at 10½d	0	5¼
Cement for making good ends of hole	0	2¼
	0	7½
Add 20 per cent profit &c	0	1½
Price of each	0	9

And 9d ÷ 9 in thickness of wall = 1d per inch deep

Allow ¾ hour for 1½ brick wall, and 1 hour for a 2 brick wall, with cement in proportion

Paving

Paving of hard Stocks, laid and jointed with Cement, Flat—This will require 35 bricks, and 1 cubic foot, or ¾ bushel, of cement per yard super The labour will be ¾ hour of a bricklayer and labourer

	s	d
35 stock bricks at 34s per 1 000	1	2¼
¾ bushel Portland cement at 1s 6d	1	2½
Labour ¾ hour bricklayer and labourer at 1s 5½d	1	1
	3	5¾
Add 20 per cent profit, &c	0	8¼
Price per yard super	4	2

Ditto, ditto, on Edge—Here 52 bricks are required per yard superficial, and a little more mortar, about 1 bushel, owing to the additional number of joints Time 1 hour in this case

	s	d
52 stock bricks at 34s per 1 000	1	9¼
1 bushel Portland cement	1	6
Labour, 1 hour bricklayer and labourer	1	5½
	4	8¾
Add 20 per cent profit &c	0	11¼
Price per yard super	5	8

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6 Panel Stable Paving Brick

to the square yard, with ¼ bushel of cement as before The price at works in Staffordshire is 67s per 1,000, and add 30s for carriage (4 tons weight per 1,000 × 7s 6d rate per ton in 5 ton lots = 30s per 1 000) = 97s at

on site

	s	d
32 blue Staffordshire stable bricks at 104s per 1 000	3	4
¼ bushel Portland cement at 1s 6d	1	2¼
Labour 1 hour bricklayer and labourer at 1s 5½d	1	5½
	6	0
Add 20 per cent profit &c	1	2
Price per yard super	7	2

Paving of Candy's "Olympia" buff vitrified Stable Paving Bricks, laid and jointed with Cement —These are 9 in × 4½ in × 2½ in, with two longitudinal grooves, and 32 cover a yard if laid straight Cement and labour as before Candy's bricks cost 67s 6d per 1 000 in trucks at Heathfield Station Devon (nearest works) and 30s 6d for carriage in 6 ton truck loads = 98s at London station plus 6s for carting two miles, and 1s for loading and unloading = 105s delivered on site Discount 15 per cent

Olympia Stable Paving Brick

	s	d
32 Candy's buff stable paving bricks at 105s per 1 000	3	4½
¼ bushel Portland cement at 1s 6d	1	2¼
Labour ¾ hour bricklayer and labourer at 1s 5½d	1	1¼
	5	8
Add 20 per cent profit &c	1	2
Price per yard super	6	10

The foregoing tallies with an actual job where it was found $4\frac{1}{3}$ bushels of cement were required per stall (6 yds sup) and a bricklayer and labourer could lay two stalls per day, twenty stalls being watched

Paving of Staffordshire Quarries 6 in × 6 in laid and jointed with Cement—These tiles or quarries as they are termed in the trade are of many qualities and colours differing in price from about 6s to 10s per 100 delivered in London The trade discount is 10 to 50 per cent A fair rate for average quality would be 8s per 100 and there are 36 of this sized tile to the square yard The attendance of a labourer would be small most of the work in connection with the laying being performed by the bricklayer alone

	s	d
36 Staffordshire quarries 6 in × 6 in at 8s per 100	2	10½
Cement for laying and jointing ⅙ bushel at 1s 6d	0	3
Labour 2 hours bricklayer at 10½d	1	9
Attendance ½ hour labourer at 7d	0	3½
	5	2
Add 20 per cent profit &c	1	0
Price per yard super	6	2

The labour will be increased if tiles of more than two colours have to be selected when laying or when the pattern is elaborate

In sending the carriage from manufacturers works in the west of England to London will be 6d to 8d per square yard with an additional 6d per square yard for packing thin tiles in casks and 8d for thick ones Small packages under 3 yards super 1s 6d each One half packing charges are allowed for empties returned in good condition carriage paid Packing loose in trucks 3d per yard super Strips and borders have different prices to plain tiles

Paving of pressed or Tesselated Tiles 4 in × 4 in laid and jointed with Cement —The following is an instructive analysis of a tiled floor as carried out in the country under the author's observation The tiles were red encaustic 1 in square laid diagonally in a porch with a border of smaller strips in three colours red buff and black The pattern was common and the tiles were bedded and jointed in cement on concrete already put down The porch measured 8 ft 6 in ×

into two doorways ma

The contractor recei

manufacturer, but no trade discount was allowed, as the quantity was so small, only a cash discount The following is the detail of whole cost —

	£	s	d
6¾ yards super best tesselated tiles at 5s per yard, P C	1	11	1¼
Packing ditto at 6d per yard super	0	3	1
	1	14	2¼
Less 2½ per cent discount for cash	0	0	10¼
	1	13	4
Carriage from manufacturer's to local railway station	0	7	3
Cartage from local railway station to site (3 miles)	0	0	9
	6¾)2	1	4
Cost of tiles only, delivered per yard super	0	6	7¾
Cement for bedd[illegible] 1 bushel	0	2	6
[illegible] 1s 1½d	2	2	0
	6¾)2	5	3
Cost of cement and labour per yard super	0	7	3½

Therefore—

	s	d
Cost of tiles only delivered	6	7¾
Cost of cement and labour	7	3½
	14	11
Add 20 per cent profit &c	2	9
Total price per yard super	16	8

The contractor's price in the quantities was only 10s per [illegible]

what it ought to have been the builder admitted this was due to dilatoriness, and lack of supervision The foregoing is a good example of how money may be lost on an item

TERRA COTTA

Moulded Terra-cotta and setting in Lime Mortar —Terra cotta is made from certain clays found principally at Tamworth, in Staffordshire Poole, in Dorsetshire Ruabon, in North Wales and other places It is taken at per foot cube in two classes—plain and moulded or enriched As the brickwork is not usually deducted the valuation is the

difference between it and terra cotta The manufacturer's price may be taken at **5s per f c** generally including models The voids to be filled up with fine cement concrete are three fourths total bulk Value is then —

	s	d
	5	0
	0	$5\frac{1}{4}$
	0	0
	0	$4\frac{1}{4}$
Lime mortar for setting $\frac{1}{10}$ f c at $7\frac{1}{2}d$	0	$0\frac{3}{4}$
Rough cutting and waste on brickwork 1 f s	0	$1\frac{3}{4}$
	6	$0\frac{1}{4}$
Deduct 1 f c brickwork excluding profit	0	$11\frac{1}{4}$
	5	$1\frac{1}{4}$
Add 20 per cent profit &c say	0	$10\frac{3}{4}$
Price per foot cube	6	0

MISCELLANEOUS

Core and Parget Smoke Flues —This is generally stated by the number without giving size or length which is an unsatisfactory practice The contractor in such a case must find out particulars from the drawings The saving of brickwork by the non deduction of flue in the Quantities should pay for the labour in forming so that only the parget rendering of lime and cowdung (1 lime to 3 dung) need be reckoned For a flue 9 in × 9 in (3 ft perimeter) and 40 ft long the value of the materials for pargetting would be —

	s	d
40 0		
3 0		
—— 120 0 = $13\frac{1}{3}$ yards super of rendering material at $1\frac{1}{2}d$	1	5
Add 20 per cent profit &c	0	3
Cost per flue	1	8

This is generally considered too low an estimate but even 1s or 1s 6d each is commonly adopted A better mode of valuation would be to state size of flue and to price at per foot run at say 1*d* for above size which would be much nearer the mark This would give **3s 4d** per flue (40 ft long) instead of **1s 8d**

Terra-cotta Chimney pot

Terra cotta Chimney pot 30 in high and Flaunched in Cement —The wholesale trade price of a terra cotta chimney pot, 30 in high

and of plain design, would average 3s 6d, but it greatly varies The trade discount off published lists is some 15 per cent It will have to be set and flaunched, or floated about with a weathering of cement

	s	d
Net cost of chimney pot 30 in high	3	6
Neat cement mortar ½ ft cube at 1s 8d	0	5
Setting &c, ½ hour bricklayer and labourer at 1s 5½d	0	9
	4	8
Add 20 per cent profit &c	0	11
Price of each	5	7

setting of 36 chimney-
nine chimney shafts
ment mortar, 1 to 1,
were used, or ¼ ft cube per pot, the flaunching being 1½ in high For labour in lifting, fixing, and flaunching a bricklayer and labourer took 12 hours, or ⅓ hour per pot This was just ordinary work and pace on a terrace of two story houses

Terra cotta Air brick

Terra cotta Air bricks, 9 in × 3 in and Built in—These cost 35s per hundred delivered on site The inside of the air flue opening would be rendered in cement mortar and the area would be 24 in girth × 9 in deep, for 1½ brick wall

	s	d
1 terra cotta air brick 9 in × 3 in at 35s per 100	0	4¼
Rendering in cement mortar 24 in × 9 in = 1 ft 6 in area ⅙ yd sup at 2s	0	4
Labour ½ hour bricklayer at 10½d	0	5¼
	1	1½
Add 20 per cent profit &c	0	2½
Price of each	1	4

The price of 9 in × 6 in air bricks is about 75s per hundred delivered and this size fits two courses in height Sometimes galvanised air bricks are specified instead of terra cotta ones

Coke Breeze Concrete Bricks 1 to 5 and built in The following materials and labour were required to produce 60

breeze bricks, 9 in × 4½ in × 3 in, in the proportion of 1 cement to 5 breeze There were two wooden moulding boxes each with spaces for 40 bricks, the use of which must not be forgotten As the materials shrank a third when wetted 9 ft cube (7½ ft cube breeze and 1½ ft cube cement) were needed in the dry to yield the 6 ft cubical content of the 80 bricks, allowing for waste

		s	*d*
Coke breeze 7½ ft cube at 3*s* 6*d* per yd cube		0	11¾
Portland cement 1½ ft cube or 1¼ bushels at 1*s* 6*d*		1	9½
Water 9 gals at say 1½*d* per 25 gals		0	0½
Labourer cleaning moulds filling and taking out bricks when set 7½ hours at 7*d*		4	4½
Use of wooden moulds		1	0
		8	2¼
Add 20 per cent profit &c		1	7¾
Price of 80 bricks	80)	9	10
Price per brick		0	1½
Building in $\frac{1}{4500}$ of labour and mortar per rod		0	0½
Price of each built in		0	2

Another trial of 288 bricks, cast at one time was as follows —

		s	*d*
Coke breeze 27 ft cube or 1 yard cube at 3*s* 6*d*		3	6
Cement 5 4 ft cube or 4⅓ bushels at 1*s* 6*d*		6	6
Water 82 gals at say 1½*d* per 25 gals		0	2
Labourer 27 hours at 7*d*		15	9
Use of moulds say		3	0
		28	11
Add 20 per cent profit &c		5	9
Price of 288 bricks	288)	34	8
Price per brick		0	1½
Building in as before		0	0½
Price of each built in		0	2

The foregoing exactly agreed with the builder's price on the same job, which was 2*d* each built in

Coke Breeze Concrete Lintels—This breeze concrete was also 1 to 5, and the lintels were fixed on first floor at about 20 ft above ground The materials and time were taken on eight lintels, the cubical contents of which together were

precisely a yard cube The following includes hoisting and casting in position —

	s	d
[illegible]	4	2
	7	6
	0	2
	15	9
	3	6
	4	5
	35	6
Add 20 per cent profit &c	7	1
Price per yard cube	27)42	7
Price per foot cube	1	7

The contractor for the same work priced his lintels from 10*d* per ft cube for large sized ones to 1*s* 9*d* per ft cube for small ones According to the foregoing actual analysis (for large lintels averaging 4 ft 9 in × 12 in × 9 in) such rates were not enough

CHAPTER IX.—MASON.

MEMORANDA.

Weights of Stones

Stone	County	Weight per Ft Cube	Ft. Cube per Ton
		Lbs	f c
Abercarne	Monmouthshire	166	13½
Ancaster	Lincolnshire	140	16
Anston	Yorkshire	141	16
Bath	Somersetshire	140	16
Boer	Devonshire	132	17
Bolsover	Derbyshire	151	15
Bramley Fall	Yorkshire	142	16
Chilmark, green beds	Wiltshire	135	16½
Corsehill	Dumfriesshire	141	16
Craigleith	Edinburgh	145	15½
Darley Dale	Derbyshire	148	15
Doulting	Somersetshire	134	16½
Forest of Dean	Gloucestershire	149	15
Granite, Aberdeen	Aberdeenshire	166	13½
,, Cheesewring	Cornwall	183	12
,, Dartmoor	Devonshire	172	13
,, Herm	Guernsey	187	12
Ham Hill	Somersetshire	142	16
Hopton Wood	Derbyshire	159	14
Howley Park	Yorkshire	160	14
Kentish Rag	Kent	166	13½
Ketton	Rutlandshire	128	17½
Mansfield, red	Nottinghamshire	149	15
,, white	,,	150	15
Marble Sicilian	Carrara Italy	169	13
Painswick	Gloucestershire	140	16
Parkspring	Yorkshire	151	15
Portland, whitbed	Dorsetshire	145	15½
,, basebed	,,	136	16½
Purbeck	,,	160	14
Roche Abbey	Yorkshire	139	16
Scotgate Ash	,,	153	14½
Whinstone	,,	172	13

The foregoing weights have been given in round numbers, chiefly for the purpose of calculating carriage and cartage.

Weights of Paving and Slabs

Description	Thickness	Weight per Ft Super	Ft Super per Ton
	In	Lbs	Ft
Yorkshire paving	2	26	86
	2½	32½	69
	3	39	57½
	3½	45½	49
	4	52	43
	4½	58½	38
	5	65	34½
	5½	71	31½
	6	78	29
Purbeck paving	2	27	83
	2½	33¾	66½
	3	40½	55½
	3½	47¼	47½
	4	54	41½
	4½	60¾	37
	5	67½	33
	5½	74	30
	6	81	28
Granite paving	3	41	54½
	4	55	40¾
	6	82	27¼
	9	123	18
Marble slabs	½	7¼	309¼
	¾	10¾	208¼
	1	14½	103¼
	1¼	18	125
	1½	21½	104
	1¾	25	89¾
	2	28¾	78
	2½	[illegible]	62¼
	3	43	52

Rubble Masonry

[illegible] ft cube [illegible] gh stone and
[illegible] ft cube [illegible] gh stone and
[illegible] 3½ yds [illegible] bed
[illegible] per [illegible]
Sand [illegible] = [illegible] = [illegible]

Flint Walling

1 yd cube [illegible] 20 ft cube [illegible] flints and 1½ ft [illegible] mortar
Also [illegible] ft [illegible] per [illegible]
[illegible] flints [illegible]
[illegible] = [illegible] [illegible] flints

Ashlar Masonry

1 f c requires $1\frac{1}{10}$ f c of undressed stone and $\frac{1}{8}$ to $\frac{1}{12}$ f c mortar
Pointing ashlar masonry requires per yd run of joint from $\frac{1}{50}$ to $\frac{1}{30}$ ft cube of mortar according to thickness

Mortar Joints

In ashlar masonry buildings of best class	$\frac{1}{16}$ to $\frac{1}{8}$ in
In first class railroad masonry as bridge piers and large arches	$\frac{3}{8}$ to $\frac{5}{8}$ in
In second class work as small piers abutments and arches	$\frac{3}{4}$ to 1 in

Miscellaneous

1 square perch = 21 ft super 18 in thick standard thickness or
1 = 18 24 in ,,
1 rod = 272 fs 18 or 24 in , or
1 , = 36 yds super 24 in thick = 24 yds cube
1 cord of stone = 100 ft cube of built walling or 128 ft cube (8 ft × 4 ft × 4 ft) of loose stone
1 ft cube of ordinary masonry = 140 to 160 lbs weight
1 ton of ordinary stacked rubble stone = 22 to 26 ft cube
1 load of rubble or stone paving = $1\frac{1}{2}$ tons

Output

A quarryman is able to turn out per day from 5 to 8 tons of lime stone and other stratified rock and from ½ to 1 ton of granite

PRICES

Waller

		s	d
Rubble walls of local stone in random courses in lime mortar	per yd cube	17	1
Ditto in squared courses in lime mortar		18	7
Rough random walling of Kentish rag in lime mortar		18	0
[illegible]		22	6
[illegible]		16	0
[illegible]		1	6
[illegible]		3	7
[illegible]		9	6
[illegible]		7	0
Ditto broken to $1\frac{1}{2}$ in cube		9	6
[illegible]		9	0
[illegible]	per yd sup	2	0
[illegible]		3	4
[illegible]		5	4

WALLER—*continued*

		s	d
Raking out joints of rubble masonry and pointing	per yd sup	0	9
	„	1	3
pointed	„	0	8
	„	0	10
Labour only, for rough facing with flints	per ft sup	0	1
Labour only, for knapped facing with flints including knapping the flints	„	0	2
Cutting into old masonry to form toothing for,			
	„	0	6
	„	0	8
	„	0	2
angles	per ft run	0	1½
	„	0	5
	„	1	0
and similar	per ton	8	0
	„	3	0
of Thames	„	7	6
	„	14	0
	„	7	0

MASON

PORTLAND STONE

(In lengths not exceeding 6 ft or above 10 ft cube, and including hoisting 30 ft)

		s	d
Portland stone in block rough quarry scabbled,	per ft cube	2	1
	„	4	0
	„	4	8
	„	5	3
	„	0	2½
	„	0	4
10 ft high	„	0	2
Taking down ashlar stone in wall, clean and stack		0	2
Arch stones, or voussoirs, rubbed on exposed faces and set in cement	„	9	4
Bases for columns plain worked when seen			
	„	10	6
		12	0
		8	5

PORTLAND STONE—*continued*

		s	d
Curb, rubbed on exposed faces, double chamfered,	per ft cube	15	2
[illegible]	„	11	0
Pier caps, worked plain, weathered on top, throated all round, and set in lime mortar	„	12	0
Plain rubbed jambs, quoins, heads, bands, tem plates, or corbels and set in lime mortar	„	6	0
Steps, square worked smooth on tread and riser, and set in lime mortar	„	7	8
Steps spandrel or winders, and ditto	„	8	0
Window sills sunk, weathered throated, grooved, and with seats and set in lime mortar	„	12	1½
Stone and all labours in plain ashlar plinths quoins, &c including hoisting setting in lime [illegible]	„	7	6
[illegible] rebi	„	9	6
[illegible] ints,	per ft sup	2	9
[illegible]	„	0	8
[illegible]	„	0	1
1 in sawn slabs at London depot supplied only	„	0	8
2 in	„	0	11
3 in	„	1	4
[illegible]	each	12	5
[illegible]	„	8	0

LABOUR		Straight. s	Straight. d	Circular s	Circular d
Face work with roughly punched or picked centre, and drafted margin not exceeding 1½ in wide	per ft sup	0	10	1	3
Roughly dressing sides of blocks	„	0	1½	0	2½
Half sawing	„	0	3	0	4½
Half plain or sawn work (one face measuring for two)	„	0	6	0	10
Plain work as in beds and joints	„	1	0	1	9
Sunk work, as in splays, weathering, batters	„	1	2	1	11
Ditto as in rebates, grooves, niches	„	2	0	3	2
[illegible]	„	2	6	3	6
[illegible]	„	—		2	4
[illegible]	„	—		3	9
[illegible]	„	0	2	0	2½
Ditto, ditto, sunk	„	0	2½	0	3
Ditto ditto, moulded	„	0	3	0	3½
Back joints to steps	per ft run	0	2	0	3
Beading single, not exceeding 2 in girth	„	0	5	0	7
Ditto staff ditto	„	0	6	0	8

LABOUR—*continued*

		Straight.		Circular	
		s	*d*	*s*	*d*
Chamfer, not exceeding 1 in wide	per ft run	0	1½	0	2
Ditto, exceeding 1 in, but not exceeding 3 in wide	,,	0	3½	0	5
Flutes, not exceeding 1½ in girth	,,	0	3	0	5
Reeds, each reed	,,	0	4	0	6
Grooves not exceeding 3 in girth	,,	0	4½	0	6
Ditto, small or throat, as *for tongues* of window sills	,,	0	2	0	3
Moulding, not exceeding 3 in girth	,,	0	10	1	2
Rebate, ditto	,,	0	4	0	5½
Rounded edge, ditto	,,	0	2½	0	4½
Tooled edge, ditto	,,	0	3	0	5

		s	*d.*
Mitred angles, external, to sunk work, chamfers, grooves rebates, mouldings, &c, under 3 in girth	each	0	3
[illegible]	,,	0	4½
[illegible]	,,	0	2
[illegible] ends of bolts, &c, each hole not exceeding 9 cubic inches	,,	0	4
Add if run with lead (labour, fuel and lead)	,,	0	4
Ditto, with neat Portland cement	,,	0	1
Mortises for newels	,,	0	10
Letting in door scrapers into step or fangs for gates and run with lead (labour, fuel, and lead)	,,	1	6
Rounded ends to plain steps	,,	0	10
Rounded corners ditto	,,	0	8
Fair ends ditto	,,	0	3
Fair ends to window sills, if taken separately	,,	0	4
Seats for jambs ditto, ditto	,,	1	0
Cutting plain letters figures, lines, &c	per inch	0	2½

Position.—If labours are done in position add one half to *foregoing* rates

YORK STONE

		s	*d*
Yorkshire stone in block 20 ft cube average delivered at railway depot London in scappled random blocks	per ft cube	3	3
Ditto, including waste and cartage within 4 miles of London depot		4	0
Ditto including hoisting scaffolding and setting in lime mortar	,,	5	3
Add if set in cement over lime mortar		0	2½
4 in landings fair tooled plain face both sides set in mortar	per ft. sup	3	0
6 in ditto, ditto ditto		3	6
2 in paving quarry tooled on face jointed and set in mortar		1	3
3 in ditto, ditto ditto		1	9
Add if fair tooled for each face	,,	0	2

YORK STONE—*continued*		s	d
Add if rubbed for each face	per ft sup	0	7
Add if laid and jointed in cement instead of mortar	,,	0	2
Raking out joints of stone paving and pointing with mortar	,,	0	1
Ditto, ditto ditto with cement	,,	0	1½
Taking up stone paving cleaning and removing under 50 yards	,,	0	1½
Taking up old paving re squaring and relaying in lime mortar	,,	0	3
Old paving new faced	,,	0	4½
2 in hearth rubbed jointed and laid in mortar	,,	1	9
6 in × 6 in tooled curbs top and one face plain and one jointed and set in mortar	per ft run	2	7
7 in. × 6 in ditto ditto ditto	,,	2	9
8 in × 6 in ditto ditto ditto	,,	3	0
	,,	3	8
	,,	4	0
	,,	0	3
	,,	0	2
	,,	2	0
	,,	2	10
throated, with stopped ends and stools, rubbed and set in mortar	,,	3	9
14 in × 6 in ditto ditto ditto ditto	,,	4	0
	,,	1	5
	,,	0	1½
	,,	0	1¾
	,,	0	2½
	,,	0	3
	,,	0	4
	,,	0	2
	,,	0	6
	,,	2	8
	,,	0	1½
	each	1	0
Rounded corners ditto	,,	0	10
Fair ends ditto	,,	0	5
	,,	0	6
	,,	0	9
	,,	0	8
	,,	0	4
r bolts	per inch	0	1
Ditto ditto, if done in position	,,	0	1½

Labours—Labour on York stone 20 to 25 per cent over Portland

ABERDEEN GRANITE

	per ft cube	7	0
	,,	9	6
	,,	0	7

ABERDEEN GRANITE—*continued*

		s	d
[illegible] ... worked fair and smooth	per ft cube	10	0
complete	„	15	0
[illegible]	„	20	0
[illegible]	per ft sup	2	6
[illegible]	„	4	3
[illegible]	„	1	2
[illegible]	„	1	9
[illegible]	„	5	0
[illegible]	„	6	6
[illegible]	„	0	11
[illegible]		3	3

Labours.—Labour on Aberdeen granite 60 per cent over Portland stone.

MISCELLANEOUS.

Ordinary work carried out in Bath stone, delivered in London, including hoisting, and setting in lime mortar	per ft cube	4	0
Sicilian marble in block, supplied only at London depôt		10	0
1 in Sicilian marble slabs or wall linings polished one side edges jointed and set complete	per ft sup	6	0
[illegible]		3	6
[illegible]		1	0
[illegible]	each	0	4
[illegible]	„	0	6
Window sills or steps taken up and removed to store and stacked	„	0	9
Pinning in ends of sills or steps in cement	„	0	6
Labour only in letting in gratings &c and set in Portland cement 3 in diam or square		0	7
Ditto ditto 6 in ditto		1	0
Ditto ditto 9 in ditto		1	3
Perforations with sides dressed plain, for areas not exceeding 1 ft sup in Portland or York stone	per inch deep	0	7
If done in position	„	0	10

MATERIALS

(WITHOUT PROFIT)

[illegible]	per [illegible] fathoms	0	10
[illegible]	per lb	0	8
Lead [illegible]	„	0	7
Sulphur ditto		0	2
[illegible] ditto		0	4
Cement, Portland	per bushel	1	6

MATERIALS—*continued*

		s	d
Lime ground fine grey chalk Dorking	per bushel	0	9
Ditto ditto lias Aberthaw		0	10
Ditto ditto white chalk		0	7½
Sand pit or river clean sharp unwashed	per yd cube	7	0
hand washed		13	6
Lime mortar fine stuff	per ft cube	0	9½
grey chalk plain white		0	7½
ash		0	8
Portland cement mortar neat		1	8
1 to 1		1	2
1 to 2		0	11½
1 to 3		0	10½
Fluate preservative for stone per surface area treated	per ft sup	0	1
Fluate crystals 1 lb dissolved covers 40 f s 2 coats	per lb	3	6
Szerelmey stone liquid in 5 gal drums (1 gal covers with 3 coats 20 y s)	per gal	7	6
Szerelmey tinting paste for ditto 60s per cwt	per lb	0	9

WAGES

Wages waller (local)	per hour	0	9
waller s labourer (local)		0	5
mason		0	10½
mason granite or marble		0	11½
mason s labourer		0	7
stone carver		1	4

ANALYSIS

WALLER

Men who do rubble work are termed "wallers" and have a distinct trade from the stonemasons or hewers

Rubble masonry is usually measured by the cubic yard

Mortar—Random or common uncoursed rubble work will require 34 cubic feet or say 1¼ cubic yard of stone (including waste) per yard cube As 24 cubic feet of rubble stone stacked equal 1 ton therefore the 34 cubic feet required per yard cube of work are equivalent to about 1½ ton the stone being sold by weight About 8½ cubic feet of mortar will be needed to fill up the voids Labour 3 hours of waller and labourer

	s	d
	4	0
	1	6
	0	6
	0	1
	4	2
	3	6
Use of scaffolding erection and removal	0	6
	14	3
Add 20 per cent profit &c	2	10
Price per yard cube	17	1

Price per foot cube $= 17s\ 1d - 27 = 7\frac{1}{2}d$

Rubble Walling of Local Stone in Squared Courses in Lime Mortar —About 36 cubic feet or say $1\frac{1}{3}$ cubic yard of stone will now be required if in thick walls as the squaring will necessitate greater waste and hence rather more rubble The $1\frac{1}{3}$ cubic yard would weigh some 14 tons Less mortar (7 cubic feet) and more labour (5 hours) are now necessary, on account of the cutting of the stone to a better fitting shape

	s	d
	4	6
	1	6
	0	6
	0	1
	3	5
	5	10
	0	6
	15	6
Add 20 per cent profit &c	3	1
Price per yard cube	18	7

Price per foot cube $= 18s\ 7d - 27 = 8\frac{1}{4}d$

The foregoing does not include pointing If walls are built in cement $\frac{1}{2}$ hour more time will be consumed in labour

Taking down old Rubble Walls in Mortar, and Cleaning and Stacking the Stone —This is merely a question of labour, and a labourer can execute a yard cube of this in 6 hours

	s	d
Taking down old rubble walls 6 hours labourer at 5*d*	2	6
Use of scaffolding erection and removal	0	6
	3	0
Add 20 per cent profit &c	0	7
Price per yard cube	3	7

Price per foot cube $= 3s\ 7d - 27 = 1\frac{1}{2}d$

Mason

In the valuation of stonework the points for consideration are the price at quarry and the state in which it is sent from there, "
and then th
to the finis
whole If the stone is worked at the quarry, there is a
of
ly-
ed
being full of quarry sap ' Granite is usually quarry worked.

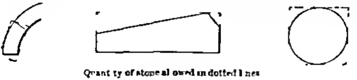
A large proportion of the stone trade is done through merchants and several large quarry owners look to them only for their business The ordinary building contractor is not always competent to undertake the stonework, and it is better for him to let the work to a firm of stone merchants

The table on subsequent page shows how the prices are arrived at for stone delivered in London and from this and the relative value of labour the costs of items in other kinds of stone may be readily ascertained by comparison with Portland The railway rate refers to full truck loads of about 4 tons and upwards

Measurement of Stone Work.—The London practice is to measure the stone per foot cube in rough blocks, and then measure the labour to each face separately in detail at per foot super There is an exception in the case of ashlar work which is usually described at per foot super, including beds and joints and stating average thickness as, for example, the alternate courses to be 9 in and 4½ in on bed and 12 in high, and specifying bond stones

Another method is to include all labour with the cubic contents, giving full descriptions and sketches The London system is the more exact, but the latter is frequently adopted to save trouble

As already stated, the full dimensions of the block stone which will contain the proposed finished stone must be taken and in large blocks 1 in is allowed each way for irregularities and waste If an experienced mason can saw



Quantity of stone allowed in dotted lines

or cut two or more pieces out of a block which is c 'y supposed to be sufficient for one then that would go to l ‹ credit and no deduction would be made

Fractions of an inch to be taken as another incl , tl ‹ 11¹ in × 5¾ in should l e called 12 in × 6 in

Beds and Joints —If these are measured in with the st r work allow 1½ ft super per cubic foot of stone in Class c work and 2 ft super in Gothic work

Labour

There is considerable difference of opinion as to the descriptions of the various labours executed on stonework but the list below is generally accepted As the cut of a saw will divide a stone into two pieces the labour to each face so cut is described as ' half sawing When other labours are stated they include this item which is only taken to a surface when no other labour is intended Half sawing is more frequently called half bed or half joint but the old description is more precise Plain work is tl surface produced after all inequalities have been dressed

... per foot super and cost are those applicable to Portland stone which is the best known in the kingdom

	Constant Hours mason	Per ft s d
Roughly dressing s des of blocks	15 at 10½d	= 0 1½
Half sawing	30	= 0 3
Half plain or sawn work straight as in beds or joints	·6	= 0 6
Ditto circular ditto ditto	95	= 0 10
Plain work straight as in faces &c	1 15	= 1 0
circular	2 00	= 1 9
Sunk work straight as in splays or batters	1 33	= 1 2
circular	2 20	= 1 11
straight as in rebates	2 30	= 2 0
circular	3 60	= 3 2
Moulded work plain straight as in cornices	2 80	= 2 6
circular	4 00	= 3 6
Circular work to shafts of columns	2 70	= 2 4
Circular circular work as in spheres and balls	1 30	= 3 9
Rubbed work extra only to foregoing plain straight	20	= 0 2
circular	21	= 0 2¼
sunk straight	21	= 0 2¼
circular	30	= 0 3
moulded straight	30	= 0 3
circular	33	= 0 3½

ANALYSIS OF THE PRIME COST OF STONES DELIVERED IN LONDON

Name of Stone	State sent	Net price on rail at Quarry per F C	Number of F C per ton	Cost of Carriage per ton to London	Cost of Carriage per F C to London	Cost per F C delivered at London Terminus
		s d		s d	s d	s d
Abercarne, Monmouthshire	Random blocks	0 4½	13½	14 6	1 0½	1 5
Ancaster, Lincolnshire	„ „	1 3	16	9 4	0 7	1 10
Anston, Yorkshire	„ „	1 4	16	10 0	0 7½	1 11½
Bath, Somersetshire	„ „	1 0	16	10 4	0 7½	1 7½
Bolsover, Derbyshire	„ „	2 6	15	8 3	0 7	3 1
Bramley Fall, Yorkshire	„ „	1 0	11	10 10	0 9½	1 9½
Chilmark, Wiltshire	„ „	1 5	16	6 0	0 4½	1 9½
Corsehill, Dumfriesshire	„ „	1 3	16	15 6	1 0	2 3
Darley Dale, Derbyshire	„ „	1 6	15	8 11	0 9	2 3
Doulting, Somersetshire	„ „	1 6	10	8 0	0 6	2 0
Forest of Dean, Gloucestershire	„ „	1 6	12	9 7	0 9½	2 3½
Granite, Aberdeenshire	Scabbled to size	—	13½*		—	4 0
Granite, Devonshire	„	—	19*		—	3 0
Ham Hill, Somersetshire	Random blocks	1 6	16	10 8	0 8	2 2
Hopton Wood, Derbyshire		2 6	14	8 4	0 7	3 1
Howley Park, Yorkshire		1 10	11	14 0	1 0	2 10
Ketton, Rutlandshire		2 6	15	7 0	0 6	3 0
Mansfield, Nottinghamshire	„ „	1 9	15	8 4	0 7	2 4
Painswick, Gloucestershire	„	1 0	16	7 9	0 6	1 6
Parkspring, Yorkshire	„ „	1 8	15	15 0	1 0	2 8
Portland, whitbed, Dorsetshire	„ „	1 7	16	7 10	0 6	2 1
Purbeck, Dorsetshire	„ „	1 6	14	7 6	0 6½	2 0½
Roche Abbey, Yorkshire	„ „	0 10	16	10 10	0 8	1 6
Scotgate Ash, Yorkshire	„	1 8	14	10 10	0 9½	2 5½
Quarella, Glamorganshire	„ „	1 6	16	10 10	0 8	2 2

Selected blocks 1d to 3d per f c extra Rough dimensions or sawn sizes 3d to 3s per f c extra over random blocks

* Carried by rail as 16 f c

Work done in position is worth half as much again as the foregoing rates

Comparative Labour —By the application of relative percentages in comparison with a well known stone like Portland the value of the labour on other stones may be easily ascertained and quickly priced For example the estimator can price all his labours at Portland rates and either add or deduct a percentage according to the hardness of the stone employed Thus labour to Bath stone is 45 per cent less and Devonshire granite 50 per cent more than that of Portland Bath stone *and* all labour compared with Portland is often priced at 25 per cent less

The following will give an idea of the comparative labour to a few important stones —

The labour on Ancaster stone is	40	per cent less than that on Portland
Bath stone	45	
Beer stone	50	
Chilmark	20	
Doulting	25	
Ketton	40	
Painswick	45	
Whitby	20	
Bolsover stone	33	more
Bramley Fall stone	20	
Darley Dale stone	20	
Granite Aberdeen	60	
Granite Devonshire	50	
Parkspring stone	23	
Seegate Ash stone	20	
Yorkshire stone	25	

Labours to Stonework

The successive stages through which freestone such as Portland Bath &c passes from the rough to the fine state are shown in the sketches as follows —

1 [illegible]
2
3
4 [illegible]
5 Pointing or picking
6 Boasting or droving
7 Tooling
8 Stroking or striping
9 Sawing or half plain work
10 Plain work
11 Dragging or combing
12 Rubbing or polishing
13 Sunk work and half sunk work
14 Moulded work
15 Reticulated work
16 Vermiculated work

Self faced rock faced, or quarry faced work is the rough exterior without any dressing

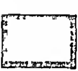
Scabbling, or scappling is roughly reducing the stones to the desired shape Quarry pitched means that the protuberances on a rough block of stone are "pitched" off at the quarry by a pitching tool which is a chisel with an

1 Self faced or Rock faced

2 Scabbling

3 Hammer Dressing

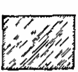
4 Punching



5 Pointing or Picking

6 Boasting or Droving

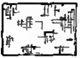
7 Tooling



8 Stroking or Striping

9 Sawing or Half plain Work

10 Plain Work



11 Dragging or Combing

12 Rubbing or Polishing

13 Sunk Work and Half sunk Work

14 Moulded Work

15 Reticulated Work

16 Vermiculated Work

edge about 2½ in wide used in conjunction with a mash hammer

Hammer dressing is of the same nature as scabbling but not so rough, and is executed with a waller's hammer

Punching is a preparatory surface to *Pointing* which latter has a pock marked appearance and is capable of being worked to an unusual degree of fineness which may be a final finish Pointing is invariably chisel drafted about an inch wide round the margins which are then styled drafted margins These borders are here necessary to ensure proper arrises for the accurate fitting of the joints

of each block, which would otherwise present an undulating surface over its whole face, they are cut with a tooth chisel

Boasting is called Droving in Scotland and may be described as roughly preparing for a finer finished face It is nearly always done with the boaster, or bolster, chisel at an angle, and varies with the texture of the stone as to the number of blows or lines to the inch, producing a corduroy appearance *Boasted work* is really a levelling of the surface, and the tool often takes $\frac{1}{16}$ in or so from the top of the stone, thus in a manner dressing it It is, in fact, "a more regular description of chiselling, in which the marks of the tool run in parallel lines each successive stroke being m

stone

over its

across the whole width of the stone, but resemble columns Limestones and grits are the stones usually boasted

Tooling is similar to boasting, except that the strokes form a continuous series of parallel lines, each line extending across the whole of the stone It is, in fact, superior boasting, the tooler, or broad tool, being a chisel 4 in wide Tooling is generally executed after the work is boasted, and is simply of an ornamental character, the operation requiring to be finely done Each line or hollow is completed before commencing the following one, and these are always at right angles to the bed of the stone The process of tooling is now uncommon

Stroking, or striped work, differs only from tooling in the direction of the lines, which run diagonally instead of parallel to the edges of the stone

Sawing, or half plain work, is the surface produced after sawing the cut

Plain e after the inequaliti t have been dressed down by chisels and tools, as the former leave their traces in irregular marks over the stone Half plain work and plain work are the labours usually left upon the bed and side joints of cut stones in walling

Drag

Dragging or combing is done with a thin plate of steel with teeth like a saw It is employed on very soft stones, such as Bath, to produce an extremely even surface, for the sake of appearance and to prevent the destroying action of

the weather which would otherwise take place on a rough texture

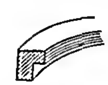
Rubbing and polishing are produced with an iron implement, used with sand and water

Sunk work is the labour of making any surface below that originally formed such as in panels, sloping surfaces of sills, &c If the original surface was smooth it is properly called sunk work, if rough, ***half sunk***

Moulded work is as its name implies, and is, strictly speaking, the term given to profiles with a change of curvature, and should not be applied to cylindrical sections, such as columns, which is circular work

Reticulated work means imitating network, and *Vermiculated work* means resembling the motion of a worm These labours are chiefly placed on quoin stones to give effect, and are enclosed by margins about ¾ in wide The irregularly shaped sinkings between are punched with a pointed tool to give them a rough pock marked appearance

Circular Work



Circular Work

Circular work, convex surfaces as to shafts of columns

Circular circular work, or spherical work, as in domes or spheres

Circular sunk work, or concave sinking, as in soffits of arches

Circular circular sunk work, as in concave surfaces of niche heads

Labours to Granite

The successive stages through which granite passes from the rough to the fine state are shown in the sketches as follows —

1 Hammer dressing or hammer blocked
2 Scabbling
3 Punching
4 Picking

termed rock or rustic work, and is mostly confined to foundations, plinths, and quoins, where a bold massive appearance is aimed at

Scabbling is still further reducing to approximate dimensions and taking down the excessive crudeness of the hammer dressed work

Punching is bringing the surface to a finer face, such as for copings, curbs, channelling, &c, and for the beds and joints of rock faced work

Picking is a further fine face, drafted margins being usually run round the parts so dressed

Bushing, bush hammering or bunching, is pounding off the roughness of the stone and leaving the face approximately smooth The face of the hammer is cut into a series

1 Hammer Dressing 2 Scabbling 3 Punching 4. Picking

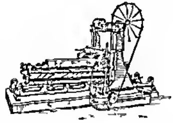
5 Bushing 6 Tooth Axing 7 Axing 8 Rubbing and Polishing

of pyramidal points, varying in number and size with the work to be done This kind of finish is only suitable for

In *Axing*, the *single* process consists of toning down the unevenness left by the pick, leaving marks in parallel lines, such as in drafted mar--
with a single axe *Fin*

and as a finish to contrast with polished work The faces of the patent-axe are formed of a number of parallel thin steel blades, bound together so as to allow of their being taken out and re sharpened

softer kinds, is now dressed by machinery, but the machines are chiefly employed at quarries where large quantities of stone are worked, and there are few builders whose business is large enough to maintain them They will not only roughly dress stone, but will saw, rub, mould, and polish it, and the advantages over manual labour are great, the saving on this alone being at least one third There is also a large saving of time in production A machine will do the work of 10 men, saving 75 per cent of the cost of ... year It only ... rio motor, at a cost of 3*d* per hour The dressing of 30 ft of moderately hard stone by machinery will cost 2*s*, while the same by hand would amount to 5*s* A stone dressing machine will work superior to clean boasted work, 180 ft super of ordinary hard grit stone per day of nine hours, at 1*d* per ft super An ashlar step, 5 ft × 12 in × 7 in, can be dressed in one hour on all four sides ready for fixing A Portland stone moulded step, 10 ft long, can be worked in 1 hour, and fine sand rubbed in ½ hour A stone machine will plane and smooth a step 8 ft × 14 in × 7 in in an hour, which would have taken a mason and sander nearly two days to complete As much as 500 ft super of rubbing can be turned out per day with a high speed machine 10 ft diameter Machine work is beautifully sharp and absolutely true ... per ft super as ... from 1*d* to 3*d* ... the stone



Stone Dressing Machine

As for turning, a Bath stone baluster 1 ft 6 in high × 6 in diameter, with twelve mouldings on it, will be finished complete in a treadle lathe in ½ hour, after first being roughed out to an octagon form To work one of these by hand would take a good mason over 3 hours

Waste—The waste in the conversion of stone depends upon its brittleness, and the irregular shape in which it is raised from the quarry, as well as upon the style of architecture The full cubic quantity should be measured, from

which the net quantity of material obtained from the length between the finished extreme points is taken The waste on the conversion of split or tooled stone will be 10 to 20 per cent and on sawn stone 5 to 7½ per cent which waste should be reckoned in pricing notwithstanding the custom of measuring the stone net

Cartage —Stone merchants charge 5*s* per load of 1½ tons for cartage within four miles Taking the weight of Portland stone at 16 ft cube to the ton this gives 2½*d* per foot cube or say 3*d* including loading and unloading for carting to site

Scaffolding —The use erection and removal of scaffolding cost 6*s* per rod in bricklayer This divided by 306 gives ¼*d* per foot cube for mason's work

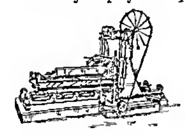
Examples Portland Stone

Portland Stone in Block roughly squared including Carting to Site Hoisting 30 ft and Setting in Lime Mortar —This is for rough work as for rubble walls &c and the six sides of the foot cube would be merely roughly dressed and squared The blocks received in London usually average 20 to 32 ft cube and the present price is 2*s* 1*d* per ft cube delivered at London terminus for sizes about 20 f c

		s	*d*
Stone in random blocks delivered at London terminus P C		2	1
Waste 20 per cent		0	5
		0	3
		0	9
	per 10 ft	0	3
		0	1
		0	0¼
		3	10¼
Add 20 per cent profit &c		0	9¾
Price per foot cube		4	8

Ditto but including Half sawing to Faces Beds and Joints and ditto —As this block will be cut out of a larger one there will be half sawing this time to the six sides of the cube The waste now allowed is only 7½ per cent, because of the sawing

Rubbing and polishing is a final surface on certain parts for [illegible] formed by machinery [illegible] of the [illegible] achines are chiefly employed at quarries where large quantities of stone are worked, and there are few builders whose business is large enough to maintain them. They will not only roughly dress stone, but will saw, rub, mould, and polish it, and the advantages over manual labour are great, the saving on this alone being at least one third. There is also a large saving of time in production. A machine will do the work of 10 men, saving 75 per cent. of the cost of working the material, and repay its outlay in a year. It only requires a 3 h.p. steam or gas engine, or electric motor, at a cost of 3*d.* per hour. The dressing of 30 ft. of moderately hard stone by machinery will cost 2*s.*, while the same by hand would amount to 5*s.* A stone dressing machine will work superior to clean boasted work, 160 ft. super of ordinary hard grit stone per day of nine hours, at 1*d.* per ft. super. An ashlar step, 5 ft. × 12 in. × 7 in., can be dressed in one hour on all four sides ready for fixing. A Portland stone moulded step, 10 ft. long, can be worked in 1 hour, and fine sand rubbed in ½ hour. A stone machine will plane and smooth a step, 8 ft. × 14 in. × 7 in., in an hour, which would have taken a mason and sander nearly two days to complete. As much as 500 ft. super of rubbing can be turned out per day with a high speed machine 10 ft. diameter. Machine work is beautifully sharp, and absolutely true. Machine sawing for Portland costs 2*d.* per ft. super as against 6*d.* by hand, and machine rubbing from 1*d.* to 3*d.* per square foot according to the nature of the stone.



Stone Dressing Machine

As for turning, a Bath stone baluster 1 ft. 6 in. high × 6 in. diameter, with twelve mouldings on it, will be finished complete in a treadle lathe in ¼ hour, after first being roughed out to an octagon form. To work one of these by hand would take a good mason over 3 hours.

Waste.—The waste in the conversion of stone depends upon its brittleness, and the irregular shape in which it is raised from the quarry, as well as upon the style of architecture. The full cubic quantity should be measured, from

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Cartage —Stone merchants charge 5*s* per load of 1½ tons for cartage within four miles Taking the weight of Port land stone at 16 ft cube to the ton, this gives 2¼*d* per foot cube, or say 3*d* including loading and unloading, for carting to site

Scaffolding —The use erection, and removal of scaffolding cost 6*s* per rod in bricklayer This divided by 306 gives ¼*d* per foot cube for mason s work

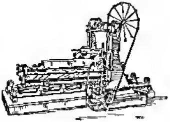
Examples Portland Stone

Portland Stone in Block, roughly squared, including Carting to Site, Hoisting 30 ft, and Setting in Lime Mortar —This is for rough work, as for rubble walls, &c, and the six sides of the foot cube would be m
The blocks received in
cube, and the present pr
at London terminus for sizes about 20 f c

	s	d
Stone in random blocks delivered at London terminus P C	2	1
Waste 20 per cent	0	5
	0	3
	0	9
	0	3
	0	1
	0	0¼
	3	10¼
Add 20 per cent profit &c	0	9¼
Price per foot cube	4	8

The waste now allowed is only 7½ per cent, because of the sawing

softer kinds is now dressed by machinery but the machines are chiefly employed at quarries where large quantities of stone are worked and there are few builders whose business is large enough to maintain them They will not only roughly dress stone but will saw rub mould and polish it and the advantages over manual labour are great the saving on this alone being at least one third There is also a large saving of time in production A machine will do the work of 10 men saving 75 per cent of the cost of working the material and repay its outlay in a year It only requires a 3 h p steam or gas engine or electric motor at a cost of *3d* per hour The dressing of 30 ft of moderately hard stone by machinery will cost *2s* while the same by hand would amount to *5s* A stone dressing machine will work superior to clean boasted work **180** ft super of ordinary hard grit stone per day of nine hours at *1d* per ft super An ashlar step 5 ft × 12 in × 7 in can be dressed in one hour on all four sides ready for fixing A Portland stone moulded step 10 ft long can be worked in 1 hour and fine sand rubbed in ½ hour A stone machine will plane and smooth a step 8 ft × 14 in × 7 in in an hour, which would have taken a mason and sander nearly two days to complete As much as 500 ft super of rubbing can be turned out per day with a high speed machine 10 ft diameter Machine work is beautifully sharp and absolutely true



Stone Dressing Machine

ft super as
m *1d* to *3d*
stone

As for turning a Bath stone baluster 1 ft 6 in high × 6 in diameter with twelve mouldings on it will be finished complete in a treadle lathe in ½ hour after first being roughed out to an octagon form To work one of these by hand would take a good mason over 3 hours

Waste—The waste in the conversion of stone depends upon its brittleness and the irregular shape in which it is raised from the quarry, as well as upon the style of architecture The full cubic quantity should be measured from

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Scaffolding —The use erection and removal of scaffolding cost 6s per rod in bricklayer This divided by 306 gives ¼d per foot cube for mason s work

EXAMPLES PORTLAND STONE

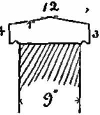
Portland Stone in Block roughly squared including Carting to Site Hoisting 30 ft and Setting in Lime Mortar —This is for rough work as for rubble walls &c and the six sides of the foot cube would be merely roughly dressed and squared The blocks received in London usually average 20 to 32 ft cube and the present price is 2s 1d per ft cube delivered at London terminus for sizes about 20 f c

	s	d
Stone in random blocks delivered at London term nus P C	2	1
Waste 20 per cent	0	5
	0	3
	0	9
	0	3
	0	1
	0	0¼
	3	10¼
Add 20 per cent profit &c	0	9¾
Price per foot cube	4	8

The waste now allowed is only 7½ per cent, because of the sawing

	s	d
Stone in random blocks delivered at London terminus P C	2	1
\ 7½ p. cent	0	2
	0	3
	1	6
	0	3
	0	1
Use of scaffolding erection and removal	0	0¼
	4	4¼
Add 20 per cent profit &c	0	10¾
Price per foot cube	5	3

T
J
wall and as the joints would be 3 ft apart one stone of this length would be analysed as below The dotted lines indicate the cubic contents out of which the block would be cut



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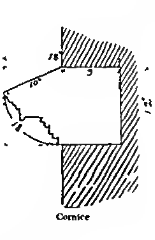
					s	d
3 0 1 0 0 4	1	0	foot cube Portland stone delivered		2	1
			Waste 7½ per cent		0	2
3 0			Cartage to site say		0	3
1 0	3	0	Bed			
2/3 0 0 3	1	6	Sides			
2/1 0 0 4	0	8	Ends or joints			
	5	2	feet super half sawing to bed sides and joints a 3d		1	3½
2/3 0 0 7	3	6	feet super straight sunk face to weathering at 1s 2d		4	1
			Carried forward		}{7	10½

				s	d
23 0			Brought forward	7	10½
0 7					
23 0	3 6		Weatherings		
0 3	1 6		Edges		
	5 0		feet super extra only for plain rubbed work at 2d	0	10
2/3 0	6 0		feet run throat at 2d	1	0
	1		foot cube hoisting and setting up to 30 ft at 1d per 10 ft	0	3
			Lime mortar at 7½d per foot cube	0	1
			Use of scaffolding 1 f c at ¼d	0	0¼
				10	0¾
Add 20 per cent profit &c				2	0¼
			Price per 3 ft run	3)12	1
			Price per 1 ft run	4	0⅓
			Equal to 12s per foot cube		

Cornice, 18 in wide × 12 in deep Weathered, with ... *Lime Mortar* —As ... , and the finished

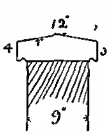


Cornice

			s	d
3 0				
1 6				
1 0	4 6	feet cube Portland stone delivered at 2s 1d	9	4½
		Waste 7½ per cent	0	8
		Cartage to site, 4½ f c at 3d per f c.	1	1½
		Carried forward	11	2

	s	d
Stone in random blocks delivered at London terminus P C	2	1
Waste 7½ per cent	0	2
	0	3
	1	6
	0	3
	0	1
	0	0½
	4	4½
Add 20 per cent profit &c	0	10½
Price per foot cube	5	3

d on
and
9 in
wall and as the joints would be 3 ft apart one stone of this length would be analysed as below The dotted lines indicate the cubic contents out of which the block would be cut

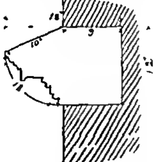


Coping

			s	d
3 0				
1 0				
0 4	1 0	foot cube Portland stone delivered	2	1
		Waste 7½ per cent	0	2
3 0		Cartage to site say	0	3
1 0	3 0	Bed		
2/3 0				
0 3	1 6	Sides		
2/1 0				
0 4	0 8	Ends or joints		
	5 2	feet super half sawing to bed sides and joints at 3d	1	3½
2/3 0				
0 7	3 6	feet super straight sunk face to weathering at 1s 2d	4	1
		Carried forward	7	10½

			s	d
23 0		Brought forward	7	10½
0 7	3 6	Weatherings		
23 0				
0 3	1 6	Edges		
	5 0	feet super extra only for plain rubbed work at 2d	0	10
2/3 0	6 0	feet run throat at 2d	1	0
	1	foot cube hoisting and setting up to 30 ft at 1d per 10 ft	0	3
		Lime mortar at 7½d per foot cube	0	1
		Use of scaffolding 1 f c at ¼d	0	0¼
			10	0¾
		Add 20 per cent profit &c	2	0¼
		Price per 3 ft run	3)12	1
		Price per 1 ft run	4	0⅓
		Equal to 12s per foot cube		

Cornice 18 *in wide* × 12 *in deep Weathered, with Moulding* 18 *in girth, Rubbed and set in Lime Mortar* —As before the length analysed would be 3 ft and the finished stone would be cut out of the dotted block

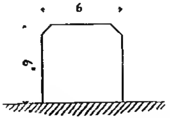


Cornice

			s	d
3 0				
1 6				
1 0	4 6	feet cube Portland stone delivered at 2s 1d	9	4½
		Waste 7½ per cent	0	8
		Cartage to site 4½ f c at 3d per f c	1	1½
		Carried forward	11	2

					s	d
			Brought forward		11	2
2/3 0 0 9	4 6		Top and bottom beds			
3 0 1 0	3 0		Back			
2/1 6 1 0	3 0		Ends or joints			
	10 6		feet super half sawing to beds back and joints at 3*d*		2	7½
3 0 0 10	2 6		feet super straight sunk face for weathering at 1*s* 2*d*		2	11
3 0 1 6	4 6		feet super plain moulded work at 2*s* 6*d*		11	3
3 0 0 10	2 6		feet super extra only for plain rubbed work to weathering at 2*d*		0	5
3 0 1 6	4 6		feet super extra only for rubbed work to moulding at 3*d*		1	1½
			2 mortises for cramps cutting only one at each side of joint at 4*d*		0	8
	4 6		feet cube hoisting and setting up to 30 ft at 1*d* per 10 ft per foot cube		1	1½
Lime mortar at 7½*d* per foot cube					0	3½
Use of scaffolding for 4½ f c at ¼*d* per f c					0	1
					31	8
Add 20 per cent profit &c					6	4
			Price of 3 ft run		3)38	0
			Price of 1 ft run		12	8

Equal to 8*s* 5*d* per foot cube



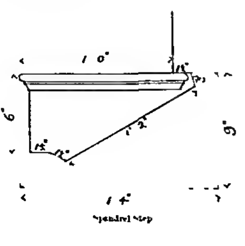
Curb.

Curb 6 in × 6 in rubbed on exposed Faces, including Beds and Joints, double chamfered, and set in Lime Mortar

—This includes joints 3 ft apart, as in previous example Chamfers are 2 in wide

			s	d
3 0 0 6 0 6	0 9	feet cube Portland stone at 2s 1d	1	7
		Waste 7½ per cent	0	1½
2/0 6		Cartage to site ¾ f c at 3d per f c	0	2
0 6	0 6	Ends or joints		
3 0 0 6	1 6	Bed		
	2 0	feet super half sawing to bed and joints at 3d	0	6
3 0 0 6	1 6	Top		
2 3 0 0 6	3 0	Sides		
	4 6	feet super plain work on exposed faces at 1s	4	6
	4 6	feet super extra only for rubbing faces at 2d	0	9
2 3 0	6 0	*feet run chamfer 2 in wide at 3½d*	1	9
		Mortar and setting	0	2
			9	6½
Add 20 per cent profit &c			1	10½
		Price of 3 ft run	3)11	5
		Price of 1 ft run	3	9½

Equal to 15s 2d per foot cube



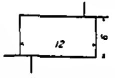
Spandrel Step

Spandrel Step 5 ft long × 12 in × 6 in, moulded and returned, rubbed on exposed Faces, and pinned in Wall in Cement.—As two steps are invariably cut out of one rectangular block, as shown in dotted lines, only the triangular piece of stone would in this case be allowed. The 5 ft includes the 6 in portion pinned into the wall, and two mortises for balusters must be allowed at the outside end.

Dimensions	Squared	Description	s	d
½/5 0				
1 4				
0 9	2 6	feet cube Portland stone, at 2s 1d	5	2½
		Waste, 7½ per cent	0	4¾
½/1 4		Cartage to site, 2¼ f c at 3d per f c	0	7½
0 9	0 6	feet super half sawing to wall end, at 3d	0	1½
5 0				
1 1½	5 8	Top		
5 0				
1 2	5 10	Soffit		
0 6				
0 6	0 3	Front of step pinned into wall		
	11 9	feet super plain face to top soffit &c, at 1s	11	9
3/5 0				
0 1½	1 11	feet super sunk work in rebates at 2s	3	10
1 0				
0 4	0 4	End (average)		
4 6				
0 6	2 3	Riser		
	2 7	feet super sunk work stopped, to riser at 1s 2d	3	0
4 6				
0 4	1 6	Front		
1 1½				
0 4	0 5	Return		
	1 11	feet super moulded work at 2s 6d	4	9½
4 6				
1 0	4 6	Tread		
4 6				
0 4	1 6	Riser		
1 0				
0 4	0 4	End (average)		
	6 4	feet super extra only for plain rubbed work, at 2d	1	0½
		Carried forward	30	9¼

Dimensions	Quantity	Description	s	d
		Brought forward	30	9¼
4 6 / 0 4	1 6	Front		
1 1½ / 0 4	0 5	Return		
	1 11	feet super extra only for rubbed work to moulding at 3*d*	0	6
	2 6	feet cube hoisting and setting up to 30 ft at 1*d* per 10 ft per f c	0	7½
	1	Stopped end to 4 in moulding	0	3
	1	Mitre to ditto	0	4
	1	Mitred and returned end to ditto	0	6
	2	Mortises for balusters at 4*d*	0	8
	1	Step jointed and pinned in wall in cement 1 hour mason + cement	1	0
		Scaffolding for 2½ f c at ¼*d* per f c	0	0¾
			34	8½
Add 20 per cent profit &c			6	11½
		Price of each step	41	8
		Equal to 16*s* 8*d* per foot cube		

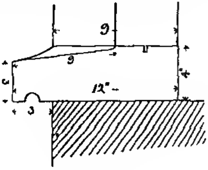
Square Step 12 *in* × 6 *in* *rubbed on exposed Faces and Bedded in Mortar*—Say 4 ft long If this is worked out of stone sawn to scantling sizes scarcely any labour will be required of the mason Back jointing extra



Square Step

Dimensions	Quantity	Description	s	d
	4	feet run of 12 in × 6 in sawn stone at 2*s* 6*d*	10	0
		Waste 7½ per cent	0	9
2 1 0		Cartage to site 2 f c at 3*d* per f c	0	6
0 6	1 0	feet super ball sawing to ends at 3*d*	0	3
4 0 / 1 0	4 0	Top		
4 0 / 0 6	2 0	Front		
	6 0	feet super extra only for rubbed work at 2*d*	1	0
		Mortar and laying near ground level	0	3
			12	9
Add 20 per cent profit &c			2	6
		Price of each step	15	3
		Equal to 3*s* 10*d* per foot run or 7*s* 8*d* per foot cube		

Window Sill 4 ft long × 12 in × 4 in sunk weathered and throated grooved for Galvanised Iron Tongue rubbed including seats for Jambs and Fair Ends and set in Mortar —If the seats for jambs were taken separately the price of each would be 1s and ditto fair ends 2d

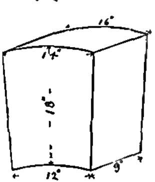


Window Sill

			s	d
4 0 1 0 0 4	1 4	feet cube Portland stone at 2s 1d	2	9¼
		Waste 7½ per cent	0	2½
		Cartage to site 1⅓ f c at 3d per f c	0	4
4 0 0 9	3 0	Top		
4 0 1 0	4 0	Bed		
4 0 0 4	1 4	Back		
2/1 0 0 4	0 8	Ends		
	9 0	feet super half sawing to top bed back and ends at 3d	2	3
4 0 0 3	1 0	feet super plain face to front edge at 1s	1	0
4 0 0 9	3 0	feet super sunk face for weathering at 1s 2d	3	6
	2	Mitres or stops to weathering at 4d	0	8
4 0 0 3	1 0	Front edge		
2/0 3 *0 3*	*0 2*	*Ends fair*		
	1 2	feet super extra only for plain rubbed work at 2d	0	2½
		Carried forward	10	11

			s	d
4 0		Brought forward	10	11
0 9	3 0	feet super extra only for sunk rubbed work to weathering at 2½d	0	7½
2/4 0	8 0	feet run groove and throat at 2d	1	4
	1 4	feet cube hoisting and setting up to 30 ft	0	4
		Mortar for setting	0	2½
		Scaffolding for 1⅓ f c at ¼d per f c	0	0¼
			13	5¼
Add 20 per cent profit &c			2	8¾
		Price of each sill	16	2

Equal to 4s 0½d per foot run or 12s 1½d per foot cube



Arch Stone

Arch Stone or Voussoir 14 in wide × 18 in long × 9 in deep rubbed on exposed Faces and set in Cement

			s	d
1 2 1 6 0 9	1 4	feet cube Portland stone at 2s 1d	2	9½
		Waste 7½ per cent	0	2½
1 2		Cartage to site 1½ f c at 3d per f c	0	4
1 6	1 9	Back		
2/0 9 1 6	2 3	Joints		
	4 0	feet super half sawing to back and joints at 3d	1	0
1 2 1 6	1 9	plain work on face at 1s	1	9
	1 9	extra only for plain rubbed work on ditto at 2d	0	3½
		Carried forward	6	4¼

			s	d
1 0		Brought forward	6	4¼
0 9	0 9	feet super sunk work circular to intrados at 1s 11d	1	7
	0 9	extra only for rubbed work on ditto at 3d	0	2
1 4				
0 9	1 0	plain work circular to top at 1s 9d	1	9
	1 4	feet cube hoisting and setting up to 30 ft	0	4
		Cement for setting	0	3¼
		Scaffolding for 1⅓ f c at ¼d per f c	0	0¼
			10	4¼
Add 20 per cent profit &c			2	0¾
		Price of each voussoir	12	5

Equal to 9s 4d per foot cube

Mortise for Baluster and run with Lead.—Each hole would be about 1 in square and would not exceed 3 cubic inches

	s	d
Cutting mortise ⅓ hour mason at 10½d	0	3½
Lead ¾ lb at 3d	0	2¼
Fuel for lead	0	0¼
Labour in running	0	0½
	0	6½
Add 20 per cent profit &c	0	1¼
Price of each	0	8

Sharpening Tools.—In reckoning the value of labour the cost of sharpening the mason's tools should not be overlooked. For this a smith may be paid 6d per score and the amount of sharpening depends upon the hardness of the stone. In some shops the masons do it themselves, but it is only a

Mac Bale s
Stone ulded
work on white Portland stone steps 5 ft × 7 in deep, with a moulding 12 in girth. Eighteen steps were machine moulded per day = 90 ft super of moulding. The cost of a day's work was—

	£	s	d
2 labourers working machine one day each = 20 hrs at 5½d	0	9	2
Steel tools making and sharpening at 45s per week = 7s 6d per day	0	7	6
Steam power say	0	5	0
Interest upon outlay at 5 per cent say	0	3	6
Total machine working 90 ft super of moulding 90)	1	5	2
1	0	0	3⅓

As hand labour of above would cost 1*s* 2*d* per ft super, the saving by machine working would be 1*s* 2*d* less $3\frac{1}{2}d = 10\frac{1}{2}d$ per ft super " Mr Powis Bale says £1 5*s* 2*d* is low, and £1 10*s* would be nearer the mark, especially as wages are higher

"With a steam lathe 42 granite columns (of all sizes above 8 in diameter) representing 1,100 ft super, can be turned in 383 hours, whereas one mason would have spent 4,428 hours in doing the same work

Yorkshire Stone

York stone, mostly from the neighbourhood of Bradford, is employed for pavings landings, hearths, steps, templates, and in such situations where wear and hardness are required It is customary with this stone to combine material and labour in one item, instead of treating them separately, as with Portland and other stones This is because it is generally tooled or sawn at the quarry, being invariably used for work of a plain character and only slightly rubbed or further finished at the site

The cost of York stone delivered in London within 4 miles of depot can readily be obtained from a stone merchant. If cut to sizes add $1\frac{1}{2}d$ per foot super Take load as $1\frac{1}{2}$ tons

Examples

Two inch York Stone Paving, rubbed, jointed and laid in Mortar—The stones are presumed to be in random sizes, with meeting joints squared Waste on conversion of paving 10 per cent

	s	*d*
1 ft super 2 in tooled paving delivered	0	C
	0	1
	0	$0\frac{1}{2}$
	0	2
	0	1
	0	2
	1	$0\frac{1}{2}$
Add 20 per cent profit, &c	0	$2\frac{1}{2}$
Price per foot super	1	3

Two inch York Stone Hearth, rubbed, jointed, and laid in Mortar—This would be cut to size out of sawn stone because of the length, and slightly rubbed and finished on face afterwards Waste on conversion of sawn hearth 5 per cent.

	s	d
1 ft super 2 in sawn hearth stone delivered	0	9
Cutting to size	0	1½
Waste 5 per cent	*0*	*0½*
Slightly rubbing and finishing one side	0	2
Mortar for laying and jointing	0	1
Labour laying ⅓ hour mason 10½*d* and labourer 7*d*	0	3½
	1	5½
Add 20 per cent profit &c	0	3½
Price per foot super	1	9

Notches in Hearths for Jambs —This would be equal to ¾ hour mason at 10½*d* plus profit = 9*d* each

Examples of York stone per cubic foot are taken in precisely the same manner as those for Portland

Edges coped or sawn are calculated thus —

			Per ft run s	d
On York stone 2 in thick	15 hour mason at 10½*d*	=	0	1½
2½ in	18	=	0	1¾
3 in	25	=	0	2½
4 in	*30*	=	0	*3*

If circular add one half to the above rates, and if sunk circular the above rates to be doubled

Granite

A mason and labourer can set 2½ ft cube per hour of granite bases to cast iron columns labour only

A mason will cut a 1½ in × 1½ in × 2 in hole in a granite step for an iron baluster in ¾ hour

A mason can cut 1 ft run of raglet ¾ in deep per hour in granite

Marble Mason

Marble is only used for such fittings as lavatory and counter tops steps chimneypieces and wall linings it is nearly always employed in the shape of slabs as veneering The sanitary manufacturer prefers to supply his own lavatory tops in which case they will be more expensive than if supplied by a marble merchant independently For polished

It comes from Carrara near Leghorn Italy, where at present 600 quarries are being worked Marina the port of export is only six miles away, and connected by a railway

CHAPTER X.—PAVIOR.

MEMORANDA

Kinds of Paving

There are, roundly speaking, 9 different kinds of paving—Brick, Tile, Stone, Asphalte, Concrete, Pebble, Pitched or Granite Setts, Tar, and Wood block

Brick and Tile are included under "Bricklayer," Stone under "Mason," while the remainder belong to "Pavior" proper Asphalte, Tar, and Wood block pavings are almost always carried out by specialists

Asphalte Paving

Thickness of Asphalte

Arch and vault coverings	½ to ¾ in
Damp proof courses, horizontal	½ ,, ¾ in
,, vertical	¾ ,, 1 in
Floors and flat roofs	¾ ,, 1¼ in
Pavements and footways	1 ,, 1½ in
Roads and carriageways	1½ ,, 2 in

Bed—Asphalte paving should have a bed of concrete 1 to 6, and thoroughly dry 3 to 6 in thick for pavements, and 6 to 9 in for roads, floated over with cement and sand and laid to proper falls and camber Underneath provide a foundation of hard filling as thick as the concrete

Life—Life of asphalte paving 15 to 20 years

Specification

Manufacture—Asphalte is from bituminous limestone called rock asphalte containing 8 to 12 per cent of bitumen (otherwise mineral pitch), the best being found in France and Switzerland. This is ground, mixed with more bitumen heated and sand or grit, the paste being then known as *mastic* and run into moulds. The blocks from these are used on site of works and remelted in a cauldron before application

Kinds of Work—There are three kinds of asphalte work—(*a*) Coarse Gritted (*b*) Fine Gritted, and (*c*) Fine "Gritted" means sand or

	s	d
1 ft super 2 in sawn hearth stone delivered	0	9
Cutting to size	0	1½
Waste 5 per cent	0	0½
Slightly rubbing and finishing one side	0	2
Mortar for laying and jointing	0	1
Labour laying ⅓ hour mason 10½*d*, and labourer 7*d*	0	3½
	1	5½
Add 20 per cent profit &c	0	3½
Price per foot super	1	9

Notches in Hearths for Jambs —This would be equal to ¾ hour mason at 10½*d*, plus profit = 9*d*. each

Examples of York stone per cubic foot are taken in precisely the same manner as those for Portland

Edges coped or sawn, are calculated thus —

		Per ft run s	d
On York stone 2 in thick	15 hour mason at 10½*d* =	0	1½
2½ in ,,	18 ,, ,, ,, =	0	1¾
3 in ,,	25 ,, ,, ,, =	0	2½
4 in ,,	30 ,, ,, ,, =	0	3

If circular add one half to the above rates, and if sunk circular, the above rates to be doubled

GRANITE

A mason and labourer can set 2½ ft cube per hour of granite bases to cast iron columns labour only

A mason will cut a 1½ in × 1½ in × 2 in hole in a granite step for an iron baluster in ¾ hour

A mason can cut 1 ft run of raglet, ½ in deep, per hour in granite

MARBLE MASON

Marble is only used for such fittings as lavatory and counter tops, steps chimneypieces, and wall linings, it is nearly always employed in the shape of slabs as veneering The sanitary manufacturer prefers to supply his own lavatory tops, in which case they will be more expensive than if supplied by a marble merchant independently For polished ...er

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MEMORANDA

Kinds of Paving.

[illegible] paving—
Br[illegible] [P]itched or
Gr[illegible]

Brick and Tile are included under "Bricklayer," Stone under "Mason," while the remainder belong to "Pavior" proper Asphalte, Tar, and Wood block pavings are almost always carried out by specialists

Asphalte Paving

Thickness of Asphalte

Arch and vault coverings	$\frac{1}{2}$ to $\frac{3}{4}$ in
Damp proof courses, horizontal	$\frac{1}{2}$,, $\frac{3}{4}$ in
,, ,, vertical	$\frac{3}{4}$,, 1 in
Floors and flat roofs	$\frac{3}{4}$,, $1\frac{1}{4}$ in
Pavements and footways	1 ,, $1\frac{1}{2}$ in
Roads and carriageways	$1\frac{1}{2}$,, 2 in

Bed —Asphalte paving should have a bed of concrete 1 to 6, and thoroughly dry 3 to 6 in thick for pavements, and 6 to 9 in for roads, floated over with cement and sand and laid to proper falls and camber Underneath provide a foundation of hard filling as thick as the concrete

Life —Life of asphalte paving 15 to 20 years

Specification

Manufacture —Asphalte is from bituminous limestone called rock asphalte containing 8 to 12 per cent of bitumen (otherwise mineral pitch), the best being found in France and Switzerland. This is ground mixed with more bitumen heated and sand or grit, the paste being then known as mastic and run into moulds The blocks from these are used on site of works and re melted in a cauldron before application

Kinds of Work —There are three kinds of asphalte work—(*a*) Coarse Gritted (*b*) Fine Gritted, and (*c*) Fine "Gritted" means sand or

	s	l
	0	J
	0	$1\frac{1}{2}$
	0	$0\frac{1}{2}$
	0	-
Mortar for laying and jointing	0	1
Labour laying ¼ hour mason $10\frac{1}{2}d$ and labourer $7d$	0	$3\frac{1}{2}$
	1	$5\frac{1}{2}$
Add ?0 per cent profit &c	0	$3\frac{1}{2}$
Price per foot super	1	9

Notches in Hearths for Jambs—This would be equal to ¾ hour mason at $10\frac{1}{2}d$ plus profit $= 9d$ each

Examples of York stone per cubic foot are taken in precisely the same manner as those for Portland

Edges coped or sawn aro calculated thus —

			Per ft run s d
On York stone	2 in thick	15 hour mason at $10\frac{1}{2}d$	$= 0\ 1\frac{1}{2}$
	$2\frac{1}{2}$ in	18	$= 0\ 1\frac{3}{4}$
	3 in	25	$= 0\ 2\frac{1}{2}$
	4 in	30	$= 0\ 3$

If circular add one half to the above rates and if sunk circular the above rates to be doubled

Granite

A mason and labourer can set $2\frac{1}{2}$ ft cube per hour of granite bases to cast iron columns labour only

A mason will cut a $1\frac{1}{4}$ in $\times$ $1\frac{1}{4}$ in $\times$ 2 in hole in a granite step for an iron baluster in ¾ hour

A mason can cut 1 ft run of raglet ¼ in deep per hour in granite

Marble Mason

Marble is only used for such fittings as lavatory and counter tops steps chimneypieces and wall linings it is nearly always employed in the shape of slabs as veneering The sanitary manufacturer prefers to supply his own lavatory tops in which case they will be more expensive than if ... ed
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MEMORANDA

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Brick and Tile are included under "Bricklayer," Stone under "Mason," while the remainder belong to "Pavior" proper. Asphalte, Tar, and Wood block pavings are almost always carried out by specialists.

Asphalte Paving

Thickness of Asphalte

Arch and vault coverings	½ to ¾ in
Damp proof courses, horizontal	½ ,, ¾ in
,, vertical	⅝ ,, 1 in
Floors and flat roofs	¾ ,, 1¼ in
Pavements and footways	1 ,, 1½ in
Roads and carriageways	1½ ,, 2 in

Bed.—Asphalte paving should have a bed of concrete 1 to 6, and thoroughly dry, 3 to 6 in. thick for pavements, and 6 to 9 in. for roads, floated over with cement and sand and laid to proper falls and camber. Underneath provide a foundation of hard filling as thick as the concrete.

Life.—Life of asphalte paving 15 to 20 years.

Specification

Manufacture.—Asphalte is from bituminous limestone called rock asphalte containing 8 to 12 per cent. of bitumen (otherwise mineral pitch), the best being found in France and Switzerland. This is ground, mixed with more bitumen heated and sand or grit, the paste being then known as mastic and run into moulds. The blocks from these are used on site of works and re-melted in a cauldron before application.

Kinds of Work.—There are three kinds of asphalte work—(*a*) Coarse Gritted, (*b*) Fine Gritted, and (*c*) Fine. "Gritted" means sand or

[illegible]

Asphalte should stand a temperature of 160° Fah without becoming appreciably soft Layers ¾ in thick or over to be in two coats, breaking joint

[illegible]

po [illegible]
wc [illegible]

cent grit and 6½ per cent mineral tar, by weight Employed for arches, roofs lining tanks, lavatory floors, damp courses &c

(c) *Fine Asphalte*—To pure asphalte, as foregoing, add 5½ per cent mineral tar, by weight Used for arches, roofs, joints, magazine floors, &c

Set of Utensils -1 cauldron or pot, 1 ladle, 1 stirrer, 1 bucket, 1 roller and 2 hand floats, complete Labour—1 cauldron man, spreaders and attendants

Covering Capacity.

1 ton asphalte	½ in thick covers	540 f s	=	60 y s
1 ,, ,,	⅝ in ,, ,,	432 ,,	=	48 ,,
1 ,, ,,	¾ in ,, ,,	360 ,,	=	40 ,,
1 ,, ,,	1 in ,, ,,	270 ,,	=	30 ,,

Asphalte Block

Claridge's Asphalte—Known as Pyrmont and Seyssel, from the Jura mountains Cast in oblong blocks, 18 in × 15 in × 6 in

Weight, 121 lbs each or 18 blocks per ton

Weight—Coarse asphalte weighs 130 lbs per f c
Fine ,, ,, 137 ,, ,,
Bitumen ,, ,, 62 ,, ,,

Coarse Flooring Asphalte— ½ in thick weighs 6 lbs 3 ozs per f s
¾ in ,, ,, 9 ,, 4 ,, ,,
1 in ,, ,, 12 ,, 5 ,, ,,


Roofing Asphalte.

Fine Roofing Asphalte

½ in thick weighs 6 lbs 9 ozs per f s
¾ in ,, ,, 9 ,, 13 ,, ,,
1 in ,, ,, 13 ,, 1 ,, ,,

Covering Capacity

4½ blocks cover 100 f s, ⅜ in thick
6½ ,, ,, ,, ½ in ,,
9 ,, ,, ,, ¾ in ,,
12 ,, ,, ,, 1 in ,,

A ton of pure No 1 mastic with 30 per cent of fine grit or coarse sand added will cover —

1 ton covers	½ in	thick	360 f s	=	40 y s
1 ,, ,,	¾ in	,,	270 ,,	=	30 ,,
1 ,, ,,	1 in	,,	160 ,,	=	20 ,,
1 ,, ,,	1¼ in	,,	153 ,,	=	17 ,,
1 ,, ,,	1½ in	,,	135 ,,	=	15 ,,

Labour —A spreader can lay per day including dusting fixing screeds running 3 in × ½ in sawn laths &c on walls of varying thickness —

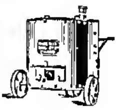
Horizontal damp course	⅜ in thick	220 f s	–	24½ y s
,, floor	½ in ,,	150 ,,	–	17 ,,
Vertical work	½ in ,,	40 ,,	–	4½ ,,
	¾ in ,,	25 ,,	=	3 ,,

Thos Faldo & Co s Asphalte —Seyssel blocks round Limmer oblong British square—all branded with Coy s name and London manufactured

French Co s Asphalte —Cast in round blocks branded with crossed ladle and stirrer Weight 56 lbs each or 40 blocks per ton

Covering Capacity — 7½ blocks cover 100 f s, ⅜ in thick
9 ,, ,, ,, ½ in ,,
15 ,, ,, ,, ¾ in ,,

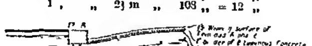
Melting —The blocks are broken up in a cauldron and fluxed with 5 per cent refined bitumen and when thoroughly cooked the asphalte is spread to required thickness with a hand float Grit is mixed with the fine asphalte for most purposes



Tar Boiler

Trinidad Asphalte Laid on 1 in binder of bitumin u c ter to n 6 in c ncrete foundation A yard cube of prepared Trinidad asphalte paving mixture weighs 1½ tons and covers —

1 y c covers	1½ in	thick	213 f s		27 y s
1 ,, ,,	2 in	,,	162 ,,	–	18 ,,
1 ,, ,,	2½ in	,,	108 ,,	=	12 ,,



Trinidad Asphalte Pavement

Val de Travers Asphalte —From Neuchatel in Switzerland Cast in hexagonal blocks 11 in across × 6½ in sides × 6½ in thick Weight 58 lbs each, or 39 blocks per ton

Weight —1 in asphalte, coarse gritted weighs 12½ lbs per f s
1 in fine gritted ,, 13 lbs. ,,
1 in without grit ,, 9½ lbs ,,

Covering Capacity—A pot holds 6 cwt asphalte, and requires 1 lb mineral tar added for fluxing 1 cwt asphalte, and 1 cwt coal as fuel

1 pot, or 6 cwt, covers, $\frac{1}{2}$ in thick 63 f s = 7 y s

Labour—2 spreaders 2 attendants, and 1 cauldron man will work and empty 2 pots three times a day, equivalent to 6 pots in all

Rock Asphalte Pavement

Lithofalt Paving Blocks—A medium between rock asphalte tar paving and tar macadam Size, 9 in × 4½ in, plain or grooved Each block is subjected to a pressure of 200 tons to ensure solidity After blocks are placed fine cement grout is brushed over the whole surface

Covering Capacity—32 blocks per yd sup, close joint

Thickness—1 in and 1¼ in, for footways, courtyards, factory floors &c 1½ in, 1¾ in, 2 in, for carriageways according to traffic

Foundations—3 in cement concrete 1 to 6, for footways in 12 ft bays
6 in " " carriageways " "
Floated with $\frac{1}{2}$ in fine cement concrete, 1 to 4 as bedding
Concrete laid on a solid bottoming of hard core

Labour—75 y s per man per day for laying the blocks only
Cost of laying about 3*d* per y s all labours included

Concrete Paving

Cement concrete paving 1 to 4 or 5, with granite aggregate $\frac{3}{4}$ in gauge is 4 or 6 in thick, laid on 4 or 6 in hard filling It should be in sections, 4 to 6 ft square, with $\frac{3}{8}$ in wooden expansion slips, otherwise it cracks

To resist wear, finish off with $\frac{1}{2}$ or 1 in coating of 1 part cement to 2 parts washed granite siftings or granite chippings $\frac{3}{16}$ in mesh, thoroughly incorporated with the concrete whilst still unset, and floated and finished to a fair even surface Latter to be roughened by by a small hand spike roller Life, 17 to 20 years

		lbs	lbs
Weight—4 in P C concrete weighs about		47 per f s	= 420 per y s
5 in " " " "		58 "	= 525 "
6 in " " " "		70 "	= 630 "

Gravel Paving

3 in of 1½ in metalling, and 2 in binding gravel, well rolled for footpaths

PEBBLE OR COBBLE PAVING

PITCHER PAVING OR GRANITE SETTS

	in		in		in		
1 ton of	3½	×	3½	×	3½	granite cubes covers	6·7 y s
	3¼	×	3¼	×	3¼		6·2
	3¾	×	3¾	×	3¾		5·8
	4	×	4	×	4		5·2
	4	×	3	×	3	setts	5·4
	4	×	4	×	3		5·3
	4	×	4	×	6		3·6
	5	×	3	×	3		4·4
	6	×	3	×	3		3·7
	7	×	3	×	3		3·0
	8	×	3	×	3		2·7
	9	×	3	×	3		2·5

Joints ⅜ in wide maximum filled with ⅜ to ⅝ in chippings to height 1 in from surface

100 gals bituminous grouting (1 cwt pitch to 2½ gals tar) to finish 15 y s joints

Fine screened gravel or sharp sand thrown on top as a finish to work in between setts

Setts laid on ¾ in sand cushion or ¾ in cement and sand rendering, on 6 in concrete foundation 1 to 6 Life 15 to 25 years

Granite weighs about 170 lbs per f c or 1 ton 13 f c

A load of granite setts or metalling 1½ tons – 20 f c

Laying—A pavior and labourer will lay including sanding or gravelling the bed and grouting —

Granite setts 5 in deep or under 11 y s per day
5 in to 7 in deep 10
7 in to 9 in 9

Taking Up—A pavior and labourer will take up old granite setts in mortar cleaning and stacking for re use

45 y s per day or 5 y s per hour

Pitcher Pavement

Tar Paving.

Top layer thickness	1 in , or	1 in , or	$1\frac{1}{4}$ in ,	$\frac{1}{4}$ to $\frac{3}{4}$ in gauge
Bottom layer, do	$1\frac{1}{2}$ in	2 in	$2\frac{3}{4}$ in ,	$\frac{3}{4}$,, $1\frac{1}{2}$ in ,,
Total ...	$2\frac{1}{2}$ in	3 in	4 in	

Two layers are the usual number, but sometimes three are specified

Stone and tar are both heated before mixing the coal tar being in the proportion of 8 to 12 gals per y c of stone Add 1 cwt pitch to 100 gals tar, to this latter To harden the mass, add $\frac{1}{2}$ to 1 bushel of dried and pounded chalk, lime, clay, brickdust, or cinders to every 12 gals. tar

Roll thoroughly with 5 or 10-cwt hand roller, and throw over top surface white spar or stone dust rolled in and finished with sand

Dress with tar and sand or grit every 2 or 3 years Life, 10 to 20 yrs

Tar paving is laid on 4 in furnace ashes, clinkers, or dry brick filling

Wood block Paving

Common sizes of wood blocks, 9″ × 3″ × 4″, or 9″ × 3″ × 5″, or 9″ × 3″ × 6″

Soft wood blocks of Baltic fir, or red or yellow deal, invariably creosoted

Hard wood blocks of Jarrah or Karri, from Australia, creosoting unnecessary

or
-in
wide

Recent practice bottom and sides dipped in creosote, laid touching and hot tar brushed over surface with chippings, gravel, or grit sprinkling

$1\frac{1}{2}$ in expansion joint next kerb, formed of bitumen, sand, or clay, kept in position by 5 in × 3 in planks

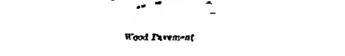
Wood blocks laid on $\frac{1}{2}$ in cushion of sand or cement rendering, on 6-in concrete foundation, 1 to 6

Life —Soft wood, 7 to 10 yrs , hard wood, 9 to 14 yrs

A load = 640 blocks = about 50 f c = 1 to $1\frac{1}{4}$ tons

Labour —A pavior and labourer will lay, including jointing and top-dressing —

10 y s per day, or 1 y s per hour



Wood Pavement

Stable Paving

From varied experience in large public stables it has been found that chamfered blue brick paving, set in cement, is best This is non absorbent, sanitary, hard, hoof resisting, and gives good foothold for horses

Life of Pavings

Asphalte road	paving	in London	lasts	15	to	20	years
Tar (footpaths)	,,	,,	,	10	,,	20	,,
Concrete	,,	,,	,,	17	,,	20	,
Granite setts	,	,,	,,	15	,	25	,,
Soft wood	,,	,	,,	7	,	10	,,
Hard wood	,,	,,	,	9	,,	14	,,
Tar macadam	,,	,	,	5	,,	10	,,

Cost ÷ life = relative economy

Comparison of Pavings

(Isaacs)

Quality	First.	Second	Third
Public hygiene	Asphalte	Granite	Wood
Noiselessness	Wood	Asphalte	Granite
Safety for horses	Wood	Asphalte	Granite
Cleansing	Asphalte	Granite	Wood
Durability	Granite	Asphalte	Wood
Economy	Granite	Wood	Asphalte
Facility for repairs	Asphalte	Wood	Granite
Facility for tramways	Granite	Wood	Asphalte

Memoranda for Road Construction

Inclinations and Angles

Inclination	Angle	Rise in ft per mile	Inclination.	Angle	Rise in ft. per mile
1 in 1	45 0	5 280	1 in 13	4 24	406
1 in 2	26 44	2 640	1 in 14	4° 5	352
1 in 3	18 25	1 760	1 in 15	3 49	337
1 in 4	14 12	1 320	1 in 16	3° 35'	330
1 in 5	11 19	1 056	1 in 17	3° 22	310
1 in 6	9 26	880	1 in 18	3° 11'	293
1 in 7	8 9	754	1 in 19	3° 0	277
1 in 8	7 8	635	1 in 20	2° 52'	264
1 in 9	6 17	586	1 in 24	2° 23'	220
1 in 10	5 43	528	1 in 25	2° 18'	211
1 in 11	5 11	480	1 in 26	2° 15'	203
1 in 12	4 46	440	1 in 30	1° 55'	176

For an inclination of 1 in 50 the tractive force required is just double that needed on the level

$$R = F + aW$$

When R = Force required to draw the load up the incline
F = Force required to draw the load on the level
a = Grade expressed as a fraction
W = Weight of the load in lbs

Surfaces and Tractive Effort

Nature of Road Surface	Force in lbs required to draw 1 ton on level
Asphalte (medium)	25 lbs
Wood paving (medium)	30
Stone blocks (good)	30
(bad)	50
Macadam (good)	45
(medium)	60
(bad)	100
Cobbles (medium)	130

Gradients

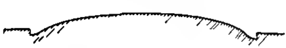
Surface of Roads	Maximum		Minimum	
	Inch per Feet	Approx Ratio	Inch per Feet	Approx Ratio
Longitudinal Fall				
Macadamized roads	1 in in 2¼ ft	1 in 30	1 in in 6¾ ft	1 in 80
Side ditches 3 ft deep	1 in 5 ft	1 60	1 in 10½ ft	1 125
Concrete side channels	1 in 10 ft	1 120	1 in 20 ft	1 210
Limestone rock asphalte	1 in 5 ft	1 60	1 in 10 ft	1 120
Trinidad Lake asphalte	1 in 2 ft	1 25	1 in 4 ft	1 50
Pitcher granite paving	1 in 2 ft	1 25	1 in 10 ft	1 120
Wood block paving	1 in 3½ ft	1 40	1 in 6¾ ft	1 80
Cross Fall				
Paved footpaths	1 in 4 ft	1 48	1 in 8½ ft	1 100
Unpaved footpaths	1 in 2 ft	1 24	1 in 4 ft	1 50

Ascent.—To evade an ascent it is allowable to increase length of road 20 times the vertical height avoided. The easier the gradient the less will be the cost of repairs. Steepest fall is called the ruling gradient.

Section of Roads

M Adam ...	1 in 72
	1 „ 60
	1 „ 50
	1 „ 70
	1 „ 50
	1 „ 33
Soft wood	1 „ 40
Hard wood	1 „ 45

S ct on w tl Stra ght Lines Ac

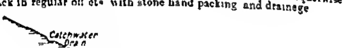


Sect o w th Flat El pse

Side Hill Roads

Slope for ordinary earth work	= $1\frac{1}{2}$ horiz to 1 vert cal
Top thickness of retaining wall	= $\frac{1}{4}$ he ght of wall
Centre	= $\frac{1}{4}$
Bottom	= $\frac{1}{3}$
External batter	= 1 in 6 to 1 in 12
Weepl oles per wall surface	1 per 4 y e chequerwise

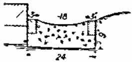
Back in regular off ets with stone hand packing and drainege



Sect on of S le H l oad &

Width of Roads

Width s reckoned mult p es f a veh le sa	8 ft
Least width f r two ve' cle t pas e e ral r	$10\frac{1}{2}$
Width f r ord nary rul es lu e f f t pathe	20 to 30
t r	30 50
c ty	50 100 „



Concrete Channel with Blue Brick Edges

Width of footpaths, ⅕ to ⅙ total breadth of roadway, 6 ft common

Increased width means increased cost of maintenance

Channels —Side channels 12 to 18 in wide, gullies 50 yds apart

Kerbs —Granite, 12 in × 8 in or 12 in × 6 in by 3 ft long on 6-in concrete Height 5 in above channel

Weights of Road Materials

	lbs		cwt	
Bardon Hill ¼ in granite chippings	84	per f c	= 20¼	per y c
Guernsey ⅜ in ,,	96	,,	= 23¼	,,
Kettering slag ⅜ in ,,	87	,,	= 21	,,
Mountsorrel ¾ in ,,	81	,,	= 19½	,,
Granite broken to 2 in. cube	103	,,	= 24¾	,,
Ragstone	100	,,	= 24	,,
Whinstone ,,	103	,,	= 24¾	,,
Fine sand dry	95	,,	= 23	,,
Coarse sand dry	100	,,	= 24	,,
Granite siftings for surface	90	,,	= 21¾	,,
Gravel	116	,,	= 28	,,
River ballast	112	,,	= 27	,,
Shingle	100	,,	= 24	,,
Water fresh	62½	,,	= 15	,,
Dust and ¼ in screenings from a stone breaker			= 23	,,
½ in to ¾ in			= 20	,,

Stones to pass a 2 in ring weigh about 3 ozs each
2¼ in ,, ,, 4 ozs
2½ in ,, ,, 6 ozs

Breaking Stones

A man can break to 2 in. cube per day (measured after breaking) —

Brick hard core &c	3½	to	4	y c
Flint field stones &c	3	,,	4	,,
Limestone whinstone &c	2	,,	2½	,,
Basalt igneous rock &c	1	,,	1½	,,
Granite syenite &c	½	,,	1	,,
By machinery various stones and sizes	60	,,	90	,,

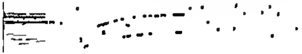
Sizes of Metalling

Upper layer is sometimes specified to be 1½ in gauge
Middle ,, ,, ,, 2 in ,,
Bottom ,, ,, 2½ in ,,
Small sizes for hard rocks, and large for softer ones
McAdam specified weight not more than 6 ozs each stone

Spreading Metalling

A labourer will spread and level in 6 in layers 30 y c metalling per day
1 y c screened hand broken metal 1 in gauge one stone thick, covers 45 y s
1 y c ditto 2 in gauge ditto covers 25 y s
1 „ 2½ in „ 22
1 unscreened ditto, ¾ to 2 in gauge ditto covers 25 to 30 y s
1 machine broken metal ¾ to 2 in gauge ditto covers 24 to 26 y s
1 y c broken stone covers 10 to 16 y s road surface packed close in rolling
1 y c ditto covers 30 to 50 y s ditto laid loosely in patching
1 y c road metal 1 in thick, theoretically covers 36 y s but practically 29 y s
1 ton ditto, ditto covers 32 y s ditto 25 y s
1 ton of 2½ in screened macadam covers about 13 y s
1 ton of ordinary metalling may be reckoned at $\frac{7}{10}$ y c
55 to 60 per cent of ordinary road metalling is solid

Thickness All thicknesses of broken stone gravel &c spread on surfaces to be calculated by aliquot parts of a measured cubic yard Thus 1 y c of broken stone or gravel is estimated to cover 12 y s, 3 in thick



Section of Modern Road

Cartage

An empty cart weighs 9 to 10 cwts say ½ ton but the net load (i e excluding weight of cart) is reckoned as being the weight carried
Loading ¼ hr man per y c

Net cart load of macadam =	23 to	24 cwts per horse per trip
Weight of cart	9	10
Gross load	32	34

Maximum load 5 cwt per inch width of tyre (Macneil)
3 (McAdam)
1 ton upon each wheel of vehicle (Telford)
Vehicles on springs diminish wear on roads especially if speed fast
Wheels of small diameter cause more wear than those of large
Wheels of about 6 ft diameter best and reduce draught for horses

Voids and Solids

		Voids	Solids
Stone broken to	1 in gauge has	45 per cent	and 55 per cent
	1½ in	42	58
	2 in	40	60
	2½ in	37	63
Gravel of various sized pebbles		37	63

VOIDS AND SOLIDS—*continued*

	Voids	Solids
	r cent, and	67 per cent
	,, ,,	78 ,,
	,, ,,	83 ,,
	ent	
	of stone	

The proportion of binder should be as little as possible, and slightly exceed voids in aggregate. Thus for 100 tons of metal allow 20 to 25 tons of binder.

TAR MACADAM

Coats	Thickness	Gauge of Stone	Tar per Yard Cube (36 gals tar, 1 cwt pitch 4 gals creosote)
	in	in in	gals
Top layer	1	¼ to ¾	12
Middle layer	2	¾ ,, 1¼	10
Bottom layer	3	1¼ 2¼	8
Total	6		

Both stones and tar are heated before use, and each coat rolled separately. Life 6 to 10 yrs. or a saving of 50 per cent in maintenance over the old mud and water method. Practically, tar macadam doubles the cost and quadruples the life of a road. 6 to 12 in stone bottoming underneath.

STEAM ROLLING

A 10 ton steam roller rolls a width of 6 ft 3 in
A 12 ton ,, ,, ,, 6 ft 5 in
A 15 ton ,, 7 ft 9 in

1 roller suffices for 100 to 120 miles of country roads with purely local traffic
1 ,, 60 80 if traffic is partly due to local industries
1 ,, ,, 40 50 ,, in provincial towns and urban districts

The useful effect of 1 steam roller is 8 000 tons of macadam per annum

The [illegible] varies according to—

(d) Area of patches
(e) Stoppages owing to traffic, &c

800 to 2 000 y s continuous metalling 3 or 4 in thick, are rolled per day
50 60 y c ,, ,,
20 70 tons ,, ,,
100 300 y s only, when in patches in repairs, or in towns, per day

Rolling	hard core	12 in thick, compresses down to	9 in thick
"	ballast	6 in	4 in
"	gravel	6 in	4 in
"	macadam	4 in	3 in

Hire of steam roller driver, fuel lubricants &c, 25s to 35s per day
Flagman, spreaders, sweepers &c, extra

Steam rolling is a necessity not a refinement It improves a road 50 to 100 per cent and reduces voids to ¼ of those in an unrolled road

On steam rolled roads farmers can draw 50 per cent heavier loads and save £5 per horse per annum

Life of a steam rolled road is 7 to 10 yrs and roller itself 25 yrs

Traction engines are of 4, 6 and 8 tons capacity with wagons

Picking Up

A labourer will pick up by hand and level 20 to 40 y s per day, 3 in deep But if the road has been excessively hardened by steam rolling only 12 to 15 y s. per day Add cost of re sharpening and repairing picks.

Scarifying

A scarifying machine will do the work of 100 men in the same time at $\frac{1}{10}$ to $\frac{1}{15}$ cost of manual labour

A machine scarifies 300 to 400 y s per hour or 2,700 to 3 600 y s per day, 3 to 4 in deep of hard macadam on fairly level roads continuous working and

A machine scarifies 150 to 200 y s per hour or, 1 350 to 1 800 y s per day, 3 to 4 in deep of hard macadam on hilly roads or interrupted by traffic

Scraping Roads

A man can scrape with a hand machine 2,300 y s of road surface per day when the surface is soft and pliable and ¼ to ½ in thick

A horse scraping machine will do 40 000 y s per day when the surface is soft and pliable and ⅜ to ½ in thick

A horse sweeping machine will brush 60 000 y s of mud per day

The track cleaned or brushed is 6 ft wide scraper or brush oblique

Scraping 340 y s	macadam	yields 1 cart load of dirt
500	granite	"
1 600	wood block	"
4 000	asphalte	"

Macadam produces	11	times as much dirt as asphalte
Granite	8	" "
Wood block	2½	" "

Asphalte is therefore cleanest, wood next while granite and macadam are very dirty

Annual Repairs

For ordinary country roads allow 20 to 50 y c metalling per mile
roads near large towns 100 400
big cities 500 1 000

Road surface annually wasted 1 y c per mile per passing horse

Annual wear on roads with light traffic ½ to 1 in of surface
heavy 3 to 4 in.

Wear due to atmospheric causes (wet &c) 20 per cent of total
action of horses feet 60
wheels of fast vehicles 20

Season for repairing macadam is wet weather—autumn and winter
tarred surfaces is dry weather—spring and summer

Maintenance

	£		£	
City roads	200	to	300	per mile per annum
Urban roads	100		150	
County main roads	70		90	
Country by roads	30		60	
English rural public roads	30		40	
Scotch	20		30	
Irish	10		20	
Inferior country roads	[illegible]		15	

	s d		s d	
Asphalte paving in London	0 6	to	1 0	per y s per annum
Granite sett	1 0		1 4	
Wood block	1 0		1 6	
Ordinary macadam	1 0		2 0	
Tarred macadam	0 4		0 9	

Damages—Cost of maintenance has increased about 30 per cent within recent years owing to traction engine and motor traffic Damage through traction engines steam lorries or carts is often assessed at 1*d* to 2*d* per ton per mile conveyed over the road Damage by extraordinary traffic sometimes £2 to £3 per mile

Supervision Cost of supervision including county surveyors and clerk s salaries office expenses audit of urban accounts &c 3 to 6 per cent on cost of maintenance

Pioneers of Road Construction

John Metcalf born at Knaresborough 1717 died at Follifoot 1810
John Loudon McAdam born at Ayr 1756 died at Moffat 1836
Thomas Telford born at Eskdale Dumfries 1757 died at Westminster 1834

Legislation

1 General Turnpike Act 1823
2 Highways and Locomotives (Amendment) Act 1878
3 Locomotives Act 1898
4 Heavy Motor Car Order 1904 Issued by Local Govt Board
5 Development and Road Improvement Funds Act 1909

Laying Dust

each and 30s per t n at works Cost £60 per mile per annum on 40 ft r ad

4 *Petroleum* 1 000 gals crude petroleum oil per ¼ mile 3 applications hot a year but rain easily washes away 5s per barrel of 24 gals at refin ry 4 000 to 6 000 gals per mile of road 16 to 18 ft wide £40 per annum for the 3 applications per mile of 16 ft road, and labour and horses £5

5 *Tarring* Hot coal or gas tar in 2 thin coats (spray best) with sand every 6 months 1 gal tar on new roads covers 4 y s and on

r dry when

y spraying

y e metal

ling both heated Laid only in fine dry weather Good but slippery Doubles cost but quadruples life of road

7 *Tarmac* Blast furnace slag mixed with tar Similar to tarred macadam

8 *Akonia* —Aconia crystals dissolved £2 13s per ton Lasts 2 months

9 *Matrix* or Gladwell system Tarred stone chippings ¼ to ½ in deep laid on road then 4 in broken stone spread and steam rolled then final matrix and more rolling

10 *Various* Dustroid (£4 per ton) Hahnite Sandinize (£6 per ton) Westrumite a tar preparation (9d per gal) and others Water and team work for each sprinkling £5 per mile of road 24 ft wide

One Horse Water Carts

				£
4 wheel	No 0—To hold 350 gals	With 4 valves for light medium or heavy sprays		44
	No 1 „	400		47
	No 2—	450 „		50
2 wheel	No 1—To hold 200 gals	With balancing gear and springs and double valves		31
	No 2—	250		33
	No 3 „	300 „		35

Distributing width of spreader about 9½ ft

Parades

F r foot traffic 4 in bottoming of hard dry f ng 4 in r ile layer of screened gravel and 1 in t p layer of fine binding gravel (t tal 6 thick when consolidated) graded and finished at a ing ground surface

F r h rse traffic d tt but 4 in middle layer of ... at a and d tt d tto

Manèges

For outdoor manèges sand, gravel or gravel and shingle mixed, with pebbles under 1½ in gauge. Broken stones unsuitable. Slope inwards to central gully, not outwards, so that the trotting ring for horses may be always well drained and dry.

Trees in Streets

Trees 10 yds apart and 9 in from back of kerb. Holes in path 2 ft × 2 ft × 3 ft deep and insert selected mould and stable manure to within 3 in of surface. Place iron gratings at bottom of trees to cover the earth and let all water and moisture into roots.

To support the tree while young drive a ricker or stout larch pole, [illegible] and secure together with wire. Ricker to have charred and tarred end in ground. Outside fix 1 in mesh wire netting or iron tree guards for protection.

The Oriental plane is the best tree for towns, but select according to soil. Grow different varieties alternately and alternated on opposite sides of street. Most suitable time for planting is between October and March when the sap is down.

Trees in streets absorb carbonic acid and other impurities in the air and thus do good as well as having a pleasant appearance.

PRICES

Foundations for Pavings

(FOR GENERAL APPLICATION)

		s	d
Dig, throw out and form surfaces under 12 in deep in common ground	per y s	0	5
Dig, throw out and form surfaces under 12 in deep in stiff clay or gravel		0	6½
Trimming and levelling common ground to surface for pavings, &c		0	2
Trimming and levelling stiff clay or gravel to surface for pavings, &c		0	2½
4 in hard core broken brick or stone as bottoming filled in levelled and rammed	,	0	7
6 in ditto ditto ditto		0	10
9 in ditto ditto ditto	"	1	3
4 in concrete foundation 1 P C to 6 ballast or gravel, and laid exclusive of digging or bottoming		1	10
6 in ditto ditto ditto		2	9
9 in ditto ditto ditto		4	2
¾ in floated cement bed on concrete for pavings		1	4
Extra only forming channels or gutters in concrete under 6 in girth	per f r	0	3
Extra only forming channels or gutters in concrete 6 in and under 9 in	,	0	5
Extra only forming channels or gutters in concrete 9 in and under 12 in	,	0	7
Dished outlets to channels and gutters	each	1	6

Asphalte Paving

The cost of asphalte greatly depends upon the quantity required locality, distance, &c, so that special quotations should always be obtained Work in the country is about 25 per cent dearer than in London, and this may be run up to 100 per cent in remote places in Scotland or Ireland The following rates embody laying in London by company's own workmen within the 4 mile radius, but are exclusive of

Paving Co Val de Travers Asphalte Co, &c, for quantities not less than 50 y s, and include hoisting up to 30 ft above ground Joints of brickwork raked out by builder. Figures indicate finished thickness, whether 1 or 2 layers

		s	d
¾ in asphalte floor or paving laid in 2 coats	per y s	5	6
1 in " " "	"	6	6
1¼ in " " "	"	7	6
1½ in " " "	"	9	0
2 in " " "	"	12	0
1 in hydraulically compressed paving slabs, 10 in × 10 in	"	5	0
1¼ in " " " "	"	6	0
1½ in " " " "	"	7	0
1¾ in " " " "	"	8	0
2 in " " " "	"	9	0
1 in Lithofalt asphalte paving blocks 9 in × 4½ in	"	4	0
1½ in " " " "	"	5	6
2 in " " " "	"	6	6
¾ in asphalte flat roofing laid in 2 coats and hoisting	"	6	6
1 in " " "	"	7	6
1¼ in " " " "	"	6	6
	"	0	0½
	"	0	0¼
50 y s	"	0	4
Taking up old asphalte, any thickness and removing	"	0	4
½ in horizontal asphalte damp-course, laid in 1 coat	per f s	0	5
⅝ in " " " "	"	0	5½
¾ in " " " laid in 2 coats	"	0	6
1 in " " " "	"	0	7
Add if in quantities under 500 f s	"	0	0½
	"	0	0¾
	"	0	1½
	"	0	0½
	"	0	8
	"	0	9
	"	0	10
1 in " " " " "	"	1	0

Asphalte Paving—*continued*		s	d
Channels or gutters 1 in bottom and sides in 2 coats with angle fillets	per f s	1	6
Extra labour only to circular channels or gutters under 6 in girth	per f r	0	4
Extra labour only to circular channels or gutters 6 in and under 9 in		0	6
Extra labour only to circular channels or gutters [illegible]		0	8
		0	7
		0	8
5 in ditto ditto ditto		0	9
6 in ditto ditto ditto		0	10
7 in ditto ditto ditto		0	11
8 in ditto ditto ditto		1	0
9 in ditto ditto ditto		1	1
Add for each inch in height		0	1
2 in horizontal angle fillet at junction of side and bottom		0	2
		0	3
		0	2
nt between		0	1
Extra labour to gutter outlets under 6 in diameter	each	1	6
6 to 12 in		2	0
rainwater openings on roof		3	0
Asphalte only supplied in blocks about ½ or 1 cwt each	per ton	85	0
Asphalte mastic flooring	per cwt	3	9
roofing		4	(
Fuel (steam coal) for mastic		1	6
Mineral tar or bitumen for fluxing		9	6
[illegible]		1	0
lte	per day	2	0
		3	0
		8	9
Attendants, 8*d*		6	8
Cauldron men 8*d*		6	8
Cartage (including filling and emptying the carts) not exceeding 1 furlong	per load or ton	3	0
Ditto for each additional furlong		0	1½

Artificial Stone Paving

			s	d
2 in Adamant stone in slabs	laid complete	per y s	5	6
2 in Hobman's Clifton	ditto ditto		3	6
2 in Homan's Granitic	ditto ditto		3	9
2 in Indurated stone	ditto ditto		5	6
2 in Macleod's Granitic	ditto ditto		3	9
2 in Stuart's Granolithic	ditto ditto		4	0
2 in Victoria stone	ditto ditto		6	0

Concrete Paving

See *Concretor*, under "Concrete for Paving" &c

Gravel Paving

		s	d
3 in of 1½ in metalling and 2 in binding gravel spread and well rolled	per y s	1	0
Picking up to a depth of 2 in gravelled surfaces for re forming	,,	0	1½
Spreading and levelling gravel or metalling up to 1 in thick	,,	0	0½
Ditto ditto ditto in 3 in layers	,,	0	0¾
Ditto ditto ditto in 6 in ,,	,,	0	0¾
Rolling with heavy horse or hand roller, up to 6 in thick	,,	0	0¾
D[illegible] ditto ditto [illegible]	,,	0	0¾
	per y c	5	0
	,,	6	6
	,,	8	0
	,,	0	7
	,,	0	3¾
	,,	10	0

Pebble or Cobble Paving

		s	d
Paving with hard pebbles av 3 in diameter, bedded endwise in coarse screened gravel, including latter	per y s	5	6
	,,	0	3
	,,	0	6
	,,	1	0
lime to 2 sand	,,	0	6
Add to last if grouted with 1 Portland cement to 2 sand	,,	0	6
Paving pebbles or cobbles, new delivered	per ton	15	6

Pitcher Paving or Granite Setts

Granite Paving	5 in deep s	d	6 in deep s	d	7 in deep s	d	8 in deep s	d	9 in deep s	d
New paving squared on face and joints, and laid complete as described above per y s	8	0	10	0	12	0	14	0	16	0
New paving in parallel courses, not exceeding 5 in wide on face, and laid complete . per y s	12	0	13	0	14	0	16	0	18	0

PITCHER PAVING OR GRANITE SETTS—*continued*

Granite Paving *continued*	5 in deep	6 in deep	7 in deep	8 in deep	9 in deep
	s d	*s d*	*s d*	*s d*	*s d*
New paving in parallel *courses, not exceeding* 3 in wide on face and laid complete per y s	14 6	15 6	16 6	19 6	22 6
Grouting joints with hydraulic lime mortar 1 to 1 per y s	0 6	0 6	0 7	0 7	0 8
neat Portland cement add per y s	1 2	1 2	1 3	1 3	1 4
1 cement and 1 sand add per y s	1 0	1 0	1 1	1 1	1 2
1 cement and 2 sand add per y s	0 9	0 9	0 10	0 10	0 11
bituminous pitch and tar per y s	1 6	1 6	1 7	1 7	1 8
Raking out joints of old paving for grouting per y s	0 7	0 7	0 8	0 8	0 9
Raking out joints of old paving and pointing 1 to 2 per y s	1 0	1 0	1 1	1 1	1 2
Add to paving if in gutters or channels separated from similar paving or in widths under 2 ft per y s	0 4	0 4	0 5	0 5	0 6
Add to ditto if curved on plan per y s	0 9	0 9	0 10	0 10	0 11
Taking up paving and clearing the space per y s	0 2½	0 2½	0 3	0 3	0 3½
Taking up paving and clearing and stacking per y s	0 3	0 3½	0 4	0 4½	0 5
Taking up paving and relaying in sand or screened gravel including making ground per y s	2 0	2 1	2 2	2 3	2 4
Labour only in laying "	1 4	1 5	1 6	1 7	1 8
Re dress old paving "	2 6	2 9	3 0	3 3	3 6
Cutting splays or circular edges to granite paving including waste per f r	0 5	0 6	0 7	0 8	0 9

		s d
Granite channels, 4 stones wide, each 5 in broad × 7 in deep dressed on face and joints, laid and jointed in gravel	per f r.	2 0
Ditto ditto ditto in cement	"	2 6
10 in × 5 in Aberdeen or Cornish granite kerb, and laying	"	3 0
10 in × 6 in " " "	"	3 6
12 in × 5 in " " "	"	3 6
12 in × 6 in " " "	"	4 0
12 in × 8 in " " "	"	5 6

PITCHER PAVING OR GRANITE SETTS—*continued*

		s	d
[illegible]	per f r	0	7
[illegible]		0	5
[illegible]	each	10	0
[illegible]		12	0
Ends of kerb jointed		0	9
Aberdeen or Guernsey granite pitchers delivered in barges below Chelsea			
5 in deep × 3 in wide granite pitchers supplied only	per ton	34	0
6 in × 3 in		32	0
7 in × 3 in		30	0
7 in × 4 in		28	0
7 in × 5 in		26	0
9 in × 4 in		24	0
Add landing rate for setts and kerbs	,	0	6
Add for cartage within 4 mile radius	per load of $1\frac{1}{2}$ tons	5	0

TAR PAVING

		s	d
$2\frac{1}{2}$ in tar paving made with broken lime tone mixed with 8 to 12 gals coal tar per y c both [illegible] the whole paving being well rolled	per y s	2	3
3 in ditto but bottom layer 2 in thick and top layer 1 in	,,	2	9
4 in ditto but bottom layer $2\frac{1}{2}$ in thick and top layer $1\frac{1}{2}$ in	,	3	9
Add to tar paving if on 4 in broken brick filling levelled	,	0	7
[illegible]	,	0	5
[illegible]	,,	0	2
[illegible] 25 yds	,	0	4
Ditto, 3 in ditto and ditto	,,	0	$4\frac{1}{2}$
Ditto 4 in ditto, and ditto	,	0	5
$\frac{1}{4}$ to $\frac{1}{2}$ in topping for tar paving including London delivery within 2 miles of wharf	per ton	26	0
$\frac{3}{4}$ to $1\frac{1}{2}$ in bottoming for tar paving including London delivery within 2 miles of wharf	,,	24	0

WOOD BLOCK PAVING

(Exclusive of digging and concrete foundation)

		s	d
[illegible] blocks &c	per y s	10	0
Ditto if blocks 9 in × 3 in × 4 in, ditto	,	9	0
Ditto , 8 in × 3 in × 5 in ditto	,	8	0
Ditto, , 8 in × 3 in × 4 in, ditto	,,	7	0

Wood Block Paving—*continued*		s	d
Deduct if blocks are not creosoted	per y s	1	8
Bitumen joints only of hot pitch and creosote	"	0	7
Grouting only of cement mortar 1 to 3	"	0	6
Clean shingle only for top dressing	"	0	2
Labour laying blocks grouting and top-dressing	"	1	5
Taking up old wood paving and removing 25 yds		0	3
Baltic fir blocks 9 in × 3 in × 5 in delivered in London	per 1 000	130	0
Yellow deal blocks ditto ditto	"	150	0
Jarrah and Karri blocks ditto ditto	"	230	0

Road Construction

Main roads 30 to 40 ft wide for heavy traffic constructed complete including bottoming metalling gravelling watering and steam rolling	per mile	£ 3 000 to £ 5 000		
By roads 20 to 30 ft wide for light traffic ditto ditto		1,000	3 000	
Roads for heavy traffic 30 ft wide between channels formed of 6 in stone bottoming 6 in granite metalling 2 in gauge and 1 in granite siftings (total thickness 13 in) with blue brick on edge channels 16 in girth on both sides of road, bedded on concrete, including digging removing and steam rolling &c, complete	per y r	£ 4	s 10	d 0
Add if channels are of 3 in × 5 in granite setts instead of brick	"	0	6	0
Add or deduct for each foot in width of road more or less	"	0	3	0
Roads for light traffic 18 ft wide between channels formed of 4 in hard bottoming 4 in granite metalling 1½ in gauge and 1 in gravel (total thickness 9 in) with blue brick on edge channels 16 in girth on both sides of road bedded on 18 in × 6 in cement concrete including digging 9 in deep removing 100 yds, spreading levelling and steam rolling &c, complete	"	1	15	0
Add if channels are of 9 in × 5 in granite setts instead of brick	"	0	6	0
Add or deduct for each foot in width of road more or less	"	0	2	0
Add for the addition of cement concrete footpaths 6 ft wide × 4 in thick on 4 in brick rubbish with 12 in × 6 in granite kerb and forming ground for each side	"	0	17	0
Heavy roads formed of 10 in stone bottoming 4 in broken stone 3 in cube 2 in metalling 1½ in gauge and 1 in gravel (total thickness 17 in) including digging levelling and steam rolling but excluding channels and footpaths	per y s	4s to 6s		
Light roads formed of 6 in stone bottoming 3 in metalling 1½ in gauge, and 1 in gravel (total thickness 10 in) including rolling &c, but excluding channels and footpaths	"	3s " 5s		

Tar mac[illegible]
gra[illegible]
2 [illegible]
1 in tar [illegible]
chipp[illegible]
Tar macad[illegible]
surface [illegible]
applying [illegible]
Supplying [illegible]
binding w[illegible]
rolling [illegible]
Ditto d tto d[illegible]
Ditto ditto d[illegible]
2 in layer [illegible]
rolling under [illegible]
Quarrying stone [illegible]
and sledging
Breaking macadam by [illegible]
stacking in heaps w[illegible]

Ditto ditto d tto 9 in
Ditto ditto ditto add if in small patches
Ditto ditto ditto over 9 in thick
Throwing broken stone from large [illegible]
(15 y c thrown per day by labourer [illegible]
per ¾ hour)
Loading metalling into cart or wag n labour only

Hauling with horse and cart on good main roads
fairly level per mile

stoppages per mile
Steam rolling continuous metalling 3 to 4 in
thick including roller fuel water cart horse
drivers spreaders sweepers brooms &c
Ditto ditto 6 in thick d tto ditto
Ditto in patches in repairs, or interrupted by
traffic

ROAD CONSTRUCTION—*continued*

		s	d
Steam rolling continuous metalling consolidated if cubic measurement	per y c	1	0
Ditto ditto ditto if by weight	per ton	1	3
Hiring steam roller including drivers fuel water cart &c but excluding spreaders sweepers &c average	per day	30	0
Picking up by hand 2 in deep gravelled or mac			
	per y s	0	1¾
		0	4
		0	0¼
		0	0½
		0	1
	per y c	0	7

PARADES

		s	d
metalling	per y s	2	6
Ditto for horse traffic but 4 in middle layer of 1½ in ragstone ditto		3	0
Ditto ditto ditto 1½ in granite ditto		4	2
Deduct if earth formation is not rolled prior to filling		0	2¼

MATERIALS.

(WITHOUT PROFIT)

		s	d
Broken brick or hard dry rubbish 2 or 3 in cube unsifted	per y c	4	6
Ditto 2 or 3 in ditto sifted		5	0
Broken flints to 1½ in guage		9	6
2 in		9	0
Broken Aberdeen or Guernsey granite metalling 1½ in gauge		17	0
Broken Aberdeen or Guernsey granite metalling 2 in gauge		16	0
Broken Kentish ragstone delivered 1 in gauge		11	0
1½ in		10	0
2 in		9	0
Broken local stone 1 or 2 in gauge		9	0
Broken slag supplied only		14	0
Cement Portland including use of bags	per bushel	1	6

MATERIALS—continued		s	d
Chalk rubble delivered	per y c	7	0
Bitumen solid	per cwt	12	0
Distilled asphalte pitch		4	0
Coal tar pitch in blocks		2	0
Coal or gas tar	per gal	0	4
Creosote oil in barrels		0	4
Stockholm tar in barrels of 28 gals at 31s		1	1
Flints faced for paving and properly dressed	per y c	9	6
unbroken as received from quarry		7	0
Granite chippings or siftings ¼ to ½ in with or without dust	per ton	13	0
Ditto ¾ in washed ditto		14	0
Ditto double screened no dust		21	0
Gravel clean unscreened best local	per y c	5	0
coarse screened or clean river ballast		6	6
fine screened good binding	"	8	0
Sand pit or river clean sharp unwashed		7	0
hand screening labour only		0	7
sea washed and dried		7	0
Shingle clean		7	6
Water for road construction *see* London Metropolitan Water Board charges Chapter IV Preliminary and Provisions			

WAGES

		s	d
Wages pavior s	per hour	0	9½
labourer s	"	0	7
excavator s		0	7½
asphalte spreader s		0	10½
attendant s		0	8
cauldron man s		0	8

ANALYSIS

ASPHALTE PAVING

¾ *in Asphalte Floor or Paving*—Blocks usually weigh about ½ cwt each When used they are broken up into small pieces and melted in a cauldron 1 lb mineral tar or bitumen being added for fluxing every cwt of asphalte (2 lbs mineral tar having first been put in for greasing)

The cauldron or pot generally holds 6 cwt asphalte and to melt this allow 1 cwt coal as fuel Two spreaders 2 attendants and 1 cauldron man will work 2 pots and empty them three times a day of 10 hours equivalent to 6 pots in all, the fires being lighted at 4 a m by the cauldron man, so as to be ready for the spreaders at 6 a m

A pot of asphalte will cover 7 yds paving $\frac{3}{4}$ in thick The analysis would therefore appear —

	s	d	s	d
1 pot or 6 cwt of asphalte at 3s 9d per cwt			22	6
7 lbs (2 + 5) = $\frac{7}{112}$ cwt mineral tar at 9s 6d per cwt			0	7
1 cwt fuel (steam coal) at 1s 6d			1	6
Cost of materials per pot			24	7
[illegible]	17	6		
	13	4		
	6	8		
	1	4		
Use of 2 pot and utensils per day at 3s per set	6	0		
Labour working 6 pots	6) 44	10		
Labour working 1 pot			7	6
Total cost of 1 pot covering 7 yds sup			32	1
Add 5 per cent contingencies for weather stoppages &c			1	7
			33	8
Add 15 per cent for profit supervision &c			5	0
Total cost of 7 yds sup			7) 38	8
Price per yd sup in thick			5	6

This agrees with the rate given on former page The establishment charges are already contained in the cost of materials when manufactured so that only 15 per cent need be added for profit supervision &c, as shown

Pebble Paving

One ton of pebbles covers 4 to 5 yds according to size and mode of laying Assume however that 1 ton of 3 in. diameter cobbles bedded endwise in gravel or sand suffices for 5 yds or ton per yd A pavior and labourer can do 20 yds a day or $\frac{1}{2}$ hr per yd Expert paviors will lay pebble paving for 6d per yds labour only Add gravel or sand and labour for forming ground

	s	d
Labour forming common ground	0	2
$\frac{1}{5}$ ton 3 in pebbles at 15s 6d per ton delivered	3	1
Coarse screened gravel for bedding say $\frac{1}{15}$ y c at 6s 6d	0	6
Labour laying $\frac{1}{2}$ hr pavior (9$\frac{1}{2}$d) and labourer (7d) at 1s 4$\frac{1}{2}$d	0	8
	4	7
Add 20 per cent profit &c	0	11
Price per yard super	5	6

PITCHER OR GRANITE PAVING

A pavior ($9\frac{1}{2}d$) and labourer ($7d$) will lay including sanding or gravelling the bed and forming ground as follows —
$9\frac{1}{2}d + 7d$ 1s $4\frac{1}{2}d \times 9$ hrs $= 12s\ 4\frac{1}{2}d$ per day

Granite setts up to 5 in deep 11 y s per day $= 12s\ 4\frac{1}{2}d - 11$
$= 1s\ 1\frac{1}{2}d$ per y s
5 to 7 in deep 10 y s per day $= 12s\ 4\frac{1}{2}d - 10$
$= 1s\ 3d$ per y s
7 to 9 in deep 9 y s per day $= 12s\ 4\frac{1}{2}d - 9$
$= 1s\ 4\frac{1}{2}d$ per y s

3 in × 7 in deep Granite Setts and laid complete in Parallel Courses —One ton of this size setts would cover about 3 y s or $\frac{1}{3}$ ton per 1 y s Add sand or gravel for bedding and surface dressing labour forming ground and labour laying as above

	s	d
[illegible]	0	2
[illegible]	10	0
[illegible]	0	2
[illegible]	1	0
Loading and unloading carts	0	6
$\frac{1}{10}$ yd cub unwashed sand at 7s	0	6
Labour laying as foregoing $12s\ 4\frac{1}{2}d \div 10$	1	3
	13	0
Add 20 per cent profit &c	2	0
Price per yard super	16	6

Add for cement or bituminous grouting as per table under Prices

Taking up Granite Paving, and Stacking —A pavior and labourer will take up of old 7 in granite setts clearing the space and stacking within 50 yds where directed 45 y s per day of 9 hrs or 5 y s per hour

	s	d
Pavior and labourer 1 hr at $9\frac{1}{2}d$ and $7d$	1	$4\frac{1}{2}$
Add 20 per cent profit &c	0	$3\frac{1}{2}$
Cost of taking up 5 yds. sup	5) 1	8
Price per yard super	0	4

WOOD BLOCK PAVING

Wood Paving of 9 in × 3 in × 5 in creosoted Baltic Fir Blocks, joints run with hot Pitch and grouted with Cement

Mortar &c—Blocks of this common size cost £6 10*s* per 1 000 delivered in London and with ½ in joints number 44 per sq yd A pavior and labourer would lay 10 y s per day including grouting and top dressing or say 1 y s per hour

	s	d
44 wood blocks at £6 10*s* per 1 000 delivered	5	8½
Hot asphaltic mixture (pitch and creosote) for bitumen joints	0	7
½ bushel cement mortar 1 to 3, for grouting at 1*s* 1*d*	0	6½
Clean shingle for top dressing at 7*s* 6*d* per y c	0	2
Labour laying blocks grouting and top dressing, 1 hr pavior and labourer at 9½*d* + 7*d* = 1*s* 4½*d*	1	4½
	8	4½
Add 20 per cent profit &c	1	7½
Price per yard super	10	0

Forming ground concrete foundation and bottoming in addition

Road Construction

Tar Macadam—The cost of tarred macadam largely depends upon the preparation of ground necessary With old paved roads where the foundation is already made only stripping and making good weak places is required but in covering new ground the insertion of a special foundation may add 30 per cent to the total value The actual cost of 40 y c as put down at Canterbury was —

Materials per Yard Cube

	£	s	d
15 yds cub pit gravel at 3*s* 6*d*	7	1*c*	6
79 gals tar at 2½*d* per gallon	0	16	5½
23½ lbs pitch at 46*s* 8*d* per ton	0	4	10½
8½ bushels coke at 9*s* 4*d* per chaldron	1	1	9½
30 bushels breeze ditto ditto	0	8	0
Wages in preparing and mixing	7	18	7
Materials for 40 yds cube	40)18	7	2½
Materials for 1 yd cube	0	9	2

This mixture is laid to a compressed thickness of 4 in or uncompressed 6 in which at 9*s* 2*d* per y c ÷ 6 = 1*s* 6*d*

per y s Laying operations will include the following items —

	s	d
	1	6
	0	9
	0	10
	0	9
	0	3
	0	5
Materials and laying 4 in thick per yd sup	[illegible]	6

The life of such a pavement being taken at 7 yrs, and annual repairs at 2*d* per y s, the whole cost amounts to less than 10*d* per y s per annum, and will be much less if the expense of stripping and foundation be deducted.

In Croydon, where the old road foundation was not disturbed and some of the old surface metal was utilised for the lower layer of the tar macadam, the total came to 3*s* 6*d* per y s 8 in thick

is
4*d*
stc
about 8*d* per ton

Breaking Macadam by Hand —This can be readily worked out from the table shown in Memoranda, and as below A labourer can break to 2-in cube per day (measured after breaking) the following amounts of varying material, and his wages would be 7*d*. × 9 hrs = 5*s* 3*d* per day Therefore—

	s d		s d	s d	
		3½ to 4 y c	= 1 6	to 1 4	per y c
		3 „ 4	= 1 9	„ 1 4	„
		2 „ 2½	= 2 6	„ 2 1	„
		1 „ 1½ „	= 5 3	„ 3 6	
		½ „ 1 „	= 10 6	„ 5 3	„

Labour only to which add 20 per cent profit, charges &c In the country lower wages will reduce foregoing prices Hand broken stone is more durable than machine broken for roads.

Breaking Macadam by Machinery —From 60 to 90 tons of macadam can be broken by machinery per day, or say 70 tons average, while the cost is a third of hand labour The chips or screenings produced run to 3 to 5 cwts per ton of rock crushed, and are useful for road surfaces. For the engine assume 1 h p nominal for every ton the machine

breaks per hour, which here gives a steam engine of 6 to 9 h p Country expenses of working per day —

	s	d	£	s	d
Engine driver at 5s per day (6d × 10 hrs)	5	0			
Foreman of stone breaker at 4s 7d per day (5½d × 10 hrs)	4	7			
Feeders of ditto 2 men at 4s 2d per day (5d × 10 hrs)	8	4			
Barrowmen contract at 3d per ton on 70 tons of stone	17	6			
Removing chips and screenings 2 men at 4s 2d per day	8	4			
[illegible]			2	3	9
[illegible]			0	4	10
[illegible]			0	3	0
[illegible]			0	1	3
[illegible]			0	4	0
[illegible]			0	3	0
[illegible]			0	2	6
Cost of breaking 70 tons		70)	8	2	4
Cost of breaking 1 ton			0	0	10½

To this net figure of 10½d per ton add the weighing of the macadam with a Pooley's weighbridge, 1 man attending at 4s 2d per day — 70 tons = ¾d per ton and ¾d for contingencies such as inclement weather or breakdowns The whole would then appear —

	s	d	
Net cost of breaking macadam	0	10½	per ton
Weighing of macadam when broken	0	0¾	
Contingencies (bad weather or breakdowns)	0	0¾	
Complete cost	1	0	

This agrees with the result of the analysis of 'Broken Stone' under *Concretor*

As a ton of ordinary metalling equals $\frac{9}{10}$ y c, the cost per yd cube is almost the same

Spreading and Levelling Metalling —A labourer will spread and level in 6 in layers 30 y c metalling per day, but including removing from heaps up to 50 yds not more than 20 y c

		s	d
Labourer 9 hrs at 7d		5	3
Add 20 per cent profit &c		1	0½
	20)	6	3½
Price per yard cube		0	3¾

If taken superficially in layers the proportion in cost would be rather more —

Per 1 in thickness	$3\frac{3}{4}d$ − 36 = $\frac{1}{8}d$	per y s.
If in 3 in layers	$3\frac{3}{4}d$ − 12 = $\frac{1}{4}d$	
If in 6 in layers	$3\frac{3}{4}d$ − 6 = $\frac{5}{8}d$	
If in 9 in layers	$3\frac{3}{4}d$ − 4 = $1d$	
If in small patches add	$\frac{1}{4}d$	

Loading — About 20 y c metalling can be filled into a cart or wagon per day including time wasted, and with wages at 5d × 10 hrs = 4s 2d per day, provincial rate, then—

4s 2d 20 y c = $2\frac{1}{2}d$ per y c or $2\frac{1}{2}d$ per ton

Team Haulage —This means horse and cart or wagon ... mately cheaper than ... e latter by frequent ... of the expense lies ... The slowest horses practically govern the amount of work done An empty cart weighs about ½ ton and the net load of macadam less than 1¼ tons or nearly 1¾ tons gross load

Cartage in country districts, at local rates, may be taken at—

On good main roads	fairly level	9d	per ton per mile
"	undulating	10d	"
"	pretty hilly	11d	"
Add if in vicinity of large towns		1d	

With net load at 1¼ tons this approximately equals the rough rule "a shilling a load a mile

Steam Haulage —When all the plant is hired steam haulage by engine and wagons up to 1 mile from the quarry is made up thus for one day's output of 70 tons macadam —

		£	s	d
		1	5	0
		0	5	7
		0	3	0
		0	4	2
		0	8	4
Steam hauling 70 tons 1 mile	70)	2	6	1
Cost per ton mile		0	0	8

If by contract, the quotation is generally 1s per ton for first mile and 6d ditto per additional mile For long distances 4½d per ton mile

Traction engine 4 tons capacity, costs £65 6 tons, £75 and 8 tons, £85

Motor Haulage —Hauling by heavy motor cars, allowing 10 per cent depreciation on a 10 year life of the vehicle —

	d
Hauling only including depreciation of motor	2½ per ton mile
Stoppages for loading and unloading	1
Trimming metal in the wagons	1½
Total cost	5

Steam Rolling —It is difficult to assess the price of steam rolling since the work done in a given time varies with such uncertain factors as weight of roller, quality of stone, thickness of coating area of patches number of stoppages, &c Large portions owing to the smaller number of waits, are rolled more quickly than small ones

Estimates also cannot be compared as different surveyors make up the total in various ways Some only include the wages of the engine driver and the actual expense of working the roller while others embody the pay of the additional men employed in spreading, binding watering and sweeping

The work per day of a 10 to 15 ton steam roller embracing everything may therefore be analysed thus —

	s	d	£	s	d
Engine driver 10 hrs at 6*d*	5	0			
Man with flag 10 hrs at 5*d*	4	2			
Coals including carting 2 miles 6 cwt at 16*s* per ton	4	10			
Lubricants oil and tallow for engine	1	0			
Depreciation interest and repairs 10 per cent	4	0			
Expenses of working the roller only			0	19	0
Spreading binding 2 labourers × 10 hrs each at 5*d*	8	4			
Watering and sweeping 2 labourers ditto	8	4			
Hire of water cart including man and horse	9	0			
Depreciation on tools—shovels scrapers brooms &c	0	4			
Spreading binding watering and sweeping			1	6	0
Total cost of steam rolling per day			£2	5	0

A steam roller costs £400 to £600 Life 25 yrs at least Renewals and repairs about £20 *per annum* Sometimes only 3 cwt of coke are used (instead of coal) and 200 gals water

For rate *per square yard* as the quantity rolled per day ranges from 800 to 2 000 y s of continuous metalling, 3 or

4 in thick (exclusive of spreading the macadam), the cost of 1 sq yd would be—

	d		d
Steam rolling 45s per day − 800 y s and 2 000 y s	¾	to	¼
Add 20 per cent profit &c say	¼		¼
Price per yard super	1		½

But when in patches in repairs or in towns with much traffic interruption, only 300 y s might be done, when the price would be much higher—

45s per day − 300 y s − 1¾d + ¼d profit = 2d per y s

For *rate per cubic yard*, as 50 to 60 y c of metalling, 3 or 4 in thick, can be rolled per day (exclusive of spreading the macadam), then—

	s	d		s	d
Steam rolling, 45s per day − 50 y c and 60 y c	0	10¾	to	0	9
Add 20 per cent profit &c say	0	2¼	„	0	1¾
Price per yard cube	1	1	„	0	10¾

Averaging 1s per y c of metalling consolidated

And for *rate per ton*, 30 to 70 tons of metalling, 3 or 4 in. thick, can be rolled per day (exclusive of spreading the macadam), so similarly—

	s	d		s	d
Steam rolling 45s per day − 30 tons and 70 tons	1	6	to	0	7¾
Add 20 per cent profit, &c say	0	3½	„	0	1½
Price per ton	1	9½		0	9¼

Averaging 1s 3d per ton of metalling consolidated

Hiring Roller —The hiring of a steam roller, as distinct from actually working one, largely depends upon the length of time employed but the following scale may act as a guide The sums include engine driver, fuel, lubricants, water cart, &c , but not labourers for spreading, binding, or sweeping

First week	Second week	Third week	After third week
£ s d	£ s d	£ s d	£ s d
9 0 0 per week	8 10 0 per week	8 0 0 per week	7 10 0 per week
1 15 0 per day	1 13 6 per day	1 12 0 per day	1 10 0 per day

If taken by the longer periods of weeks, the divisible proportion is smaller—

30s per day 28s per day, 27s per day, 25s per day

Say 25s to 35s per day Contract tonnage price for hiring is usually 1s to 1s 6d

The charges for hiring 25 cwt horse rollers for parades, and 5 or 10 cwt hand rollers for paths, are of course far less

Picking up Road Surfaces by Hand —This means picking
or round
off up to
o 20 y s
whether
depth picked is 2 in or 3 in

London wages, 7d × 9 hrs = 5s 3d per day, and country figure, say 5d × 10 hrs = 4s 2d per day Therefore—

	d		d	
London —5s 3d ÷ 40 and 20 y s	1¼	2 in deep	3¼	3 in deep
Add 20 per cent profit &c	0¼	„	0¾	„
Price per yard super	1½		4	„

	d		d	
Country —4s 2d ÷ 40 and 20 y s	1¼	2 in deep	2½	3 in deep
Add 20 per cent profit, &c	0¼	„	0½	„
Price per yard super	1½	„	3	„

If surface has been excessively hardened by steam rolling only 12 to 15 y s per day Some allowance for re sharpening and repairing picks has to be considered

Machine Scarifying —A modern mechanical scarifier is far superior to hand labour in picking up or stocking, both in time and economy Such a machine will do the work of a hundred men in the same period, at $\frac{1}{10}$ to $\frac{1}{14}$ cost of manual labour, the total saving, with all charges being about 100 per cent

Rutty s or Morrison's machines will scarify 300 to 400 y s per hour = **3,000** y s per day, average, 3 to 4 in deep, of hard macadam on fairly level roads, with continuous working And **150** to **200** y s per hour = 1,500 y s per day, average, ditto, on hilly roads or interrupted by traffic

The days work of a steam scarifier with local charges is made up thus —

	s	d
Engine driver 10 hrs at 6d	5	0
Scarifier attendant 10 hrs at 5d	4	2
Road attendant 10 hrs at 5d	4	2
Coals including carting 6 cwt at 16s per ton	4	10
Lubricants oil and waste	1	0
Sharpening scarifier tools 5½ hrs at 5d	2	4
Depreciation and repairs on machine	4	0
Hire of water cart for supplying engine ½ day at 9s	4	6
Cost of scarifying per day	30	0

	d
Level roads 30s per day — 3 000 ys	⅛
Add profit &c say	⅛
Price per yard super	¼

	d
Hilly roads 30s per day 1 500 ys	¼
Add profit &c say	¼
Price per yard super	½

London or town rates would be about double foregoing i.e ½d to 1d per ys on account of higher wages fuel and incidental expenses

Maintenance —The cost of annual maintenance has already been given in detail under Memoranda but the average upkeep of English main roads has been put by some authorities at £100 per mile per annum It has greatly increased on account of traction engines and motors the latter being especially important and the pneumatic tyres having a suction action Under the Development and Road Improvement Funds Act 1909 a Road Board was created to financially assist the local committees the additional money being raised by the yield on two taxes—motor spirit duties and motor car licenses These at present produce about £600 000 a year and out of this sum advances are made to the County Councils and Highway Authorities To improve the crust bituminous binding materials and tarred surfaces are recommended in place of the old water bound system

Where traffic is considerable the width of roads has such

macadam street averages 1s 7d per y s and in Parliament

1

"Stocking means lifting the roadway, or loosening the old surface material with picks

	£	s	d
Stocking —1? days labourer at 4s 2d (5*l* × 10 hrs)	2	10	0
Stone —158 tons at 6s per ton	47	8	0
Horse hire 15 days at 9s	6	15	0
Labour spreading 6¼ days at 4s 7d (5½d × 10 hrs)	1	8	8
Sand —43 tons at 2s per ton	4	6	0
Horse hire 6½ days at 9s	2	18	6
10 hrs)	1	8	8
	1	7	0
	1	10	0
	0	15	0
	0	12	6
	0	9	6
Total cost for 1 422 yds sup 1 422)	71	8	10
Price per yard super	0	1	0

This 1s per y s is therefore approximately made up as follows —

	s	d
Stocking or lifting	0	0½
Stone and spreading	0	9¼
Sand and spreading	0	1½
Water and sprinkling	0	0¼
Rolling and flagman	0	0½
Total per y s	1	0

The foregoing is incidental to re metalling only, to which must be added the cost of cleansing, sweeping scraping watering and small repairs necessary to keep the road in good condition as well as supervision, which usually amounts to 5 or 6 per cent of the total expenditure

CHAPTER [illegible]

[illegible]

Names	Size	Gauge for 3 in lap, in inches [illegible]	Gauge [illegible]	[illegible]	[illegible]
	in	in	in	[illegible]	[illegible]
Singles	12 × 8	4½	4	[illegible]	[illegible]
Doubles	13 × 6	5	4½	[illegible]	[illegible]
Ladies	16 × 8	6½	6	[illegible]	[illegible]
Viscountesses	18 × 10	7½	7	[illegible]	[illegible]
Countesses	20 × 10	8½	8	[illegible]	[illegible]
Marchionesses	22 × 11	9½	9	[illegible]	[illegible]
Duchesses	24 × 12	10½	10	[illegible]	[illegible]
Princesses	24 × 14	10½	10	12·2	[illegible]
Empresses	26 × 16	11½	11	[illegible]	[illegible]
				A	
Imperials	30 × 24	13½	—	2·5	—
Rags	36 × 24	16½	—	2·2	—
Queens	36 × 24	16½	—	2·2	—

A —Squares covered by 1 ton

The sizes sometimes slightly vary, according [illegible]

Classification —Slates are classed accor[illegible] straightness, smoothness of surface, fair [illegible] presence or absence of discoloration, &c [illegible] generally divided into first and second qualit[illegible] some cases a medium quality is quoted Slates [illegible] quality are thinner and lighter than those of inferior [illegible]

Rule per Square —Rule to find the numb[illegible] required to cover one square —One square in inc[illegible] width of slate in inches × gauge in inches

Weight —[illegible] super for all [illegible] lap and nails [illegible]

Nails—As there are two nails per slate, the number required per square will be found by doubling the number of slates

Buying—The trade "Thousand," or "long tally," equals 1,200 for buying and selling, and the trade "Hundred" equals 120 ditto Imperials, rags, and queens are sold by the ton.

Slate Slabs

300 ft super,	½ in thick,	weigh 1 ton	and 1 ft super	weighs	7½ lbs
200 ,,	¾ ,,	,,	,,	,,	11¼ ,,
150 ,,	1 ,,	,,	,,	,,	15 ,,
120 ,,	1¼ ,,	,,	,,	,,	18¾ ,,
100 ,,	1½ ,,	,,	,,	,,	22½ ,,
85 ,,	1¾ ,,	,,	,,	,,	26¼ ,,
75 ,,	2 ,,	,,	,,	,,	30 ,,

PRICES

Slates to be of good Bangor, Port Madoc, or others of equal quality or value, with 3-in lap, and 2 nails to each slate

		s	d
	per square	38	0
	,,	42	0
	,,	40	0
	,,	2	0
	,,	1	6
	,,	3	0
	,,	6	6
	,,	3	0
	,,	9	0
	per ft sup	0	7
	per ft run	0	1½
	,,	0	2
Ridge or hip tile, 7 in wings, plain dead joints, terro metallic blue, red or buff, set in hair mortar and pointed with cement	,,	0	10½
Ditto with raised roll, and ditto	,,	1	1
	,,	0	2
	,,	2	5
	,,	1	7
	,,	0	4½
	,,	0	3
	,,	0	2
Galvanised iron hip hooks and fixed	each	1	6
Make good slating to pipe passing through roof	,,	2	6

Slate Masonry

ils, cisterns, &c ,
of cut to any size
re

Description		¾ in		1 in		1¼ in	
		s	*d*	*s*	*d*	*s*	*d*
Slabs quarry planed or self faced (obtained by splitting) under 16½ ft super supplied only	per ft sup	0	11	1	1	1	3
Ditto from 16½ to 30 ft super supplied only	per ft sup	1	1	1	4	1	7
Setting slate slabs of any size in mortar	per ft sup	0	2	0	2½	0	3
		0	2	0	2	0	2
		0	3	0	3½	0	4
		0	1½	0	2	0	2½
		0	2	0	2	0	2
		1	0	1	1	1	1
	per ft run	0	3½	0	4	0	4½
Chamfering from 1 in to 2 in wide and rubbing	,,	0	2	0	2	0	2
Ditto ditto circular	,,	0	3	0	3	0	3
Circular cutting	,,	0	3½	0	4	0	4½
Edges sawn	,,	0	1	0	1½	0	2
,, filed	,,	0	2	0	2½	0	3
,, rubbed	,,	0	2	0	2½	0	2½
,, circular	,,	0	3	0	4	0	5
Grooving up to 1½ in girth	,,	0	3	0	3	0	3
Rounded nosings straight	,,	0	3	0	3½	0	4
circular	,,	0	3½	0	4½	0	5½
Rebating on edges up to 3 in girth	,,	0	2	0	2½	0	2½
,, ,, circular	,,	0	3	0	3½	0	3½
Scribing	,,	0	4	0	4½	0	5
Throating straight	,,	0	1	0	1½	0	2
,, circular	,,	0	1½	0	2	0	2½
	,,	[illegible]	2	0	2½	0	3
			1	0	1½	0	2
			2½	0	3½	0	4½
			0	2	3	2	6
for screws	per dozen	1	4	1	6	1	8
Screws copper strong 2 in , for fixing slate fittings supplied only	per dozen	0	10	0	10	0	10
Partitions and slabs taken down and re moved to store	per ft. sup	0	1	0	1	0	1

SLATE MASONRY—*continued*

		s	d
Slate channel course for urinals, &c, 9 in × 4 in, with semi circular 3 in channel dished to current and set in cement	per ft run	4	6
Labour only in sinking 3 in channel, with current ½ in deep	,,	0	5
Slate skirting 6 in × ¾ in, planed one side chamfered and fixed with screws	,	0	10
Stopped ends to channels labour only	each	0	9
,, chamfers grooves &c	,	0	1
Cutting holes in slate channels 3 in thick and rebating for grating	,	2	0
Mortises or rail holes up to 1½ in deep	,,	0	4
Mitres for fillets under 3 in wide	,,	0	4
Plugs lead (labour fuel and lead)	,	0	4
Slate cisterns various sizes fixed complete average	per gal	0	6½

				£	s	d
Slate cisterns	1 in thick fixed complete	100 gals	each	3	0	0
	1¼ in ,	150 ,,	,	4	0	0
	1¼ in	200 ,,	,	5	10	0
	1½ in	250 ,,	,,	6	10	0
	1½ in	300 ,	,	7	10	0

MATERIALS

(WITHOUT PROFIT)

		s	d
Cement oil	per lb	0	2
Cement red lead	,,	0	3½
Oil putty, slate colour	,,	0	4
Clips strong for slates copper	,	1	6
, lead	,,	0	3½
, zinc	,,	0	5
Nails slating composition	,,	0	8
, , copper cast	,,	1	2
,, wrought	,,	1	4
,, iron dipped in boiled oil or painted	,,	0	5
zinc		0	6
Cement Portland	per bushel	1	6
Lime ground grey chalk	,	0	9
Hair grey lime mortar	per ft cube	0	8½
Portland cement mortar neat		1	8
1 to 1		1	2
1 to 2		0	11½
,, 1 to 3	,,	0	10½

			£	s	d
Slates, Port Madoc price at Welsh port,	Singles	per 1 200	2	15	0
,, ,, ,, ,,	Doubles	,,	3	0	0
,, ,, ,, ,,	Ladies	,,	3	15	0
,, ,	Viscountesses	,,	6	0	0
,, , , ,,	Countesses	,	8	0	0
,, , , ,,	Marchionesses	,,	9	15	0
,, ,, ,, ,,	Duchesses	,,	13	0	0
, , ,	Princesses	,,	14	10	0
,, ,, ,, ,,	Empresses	,,	16	10	0

Precelly Slates.

		s d
Precelly Welsh green slating laid to 3 in lap in diminishing courses with copper nails	per square	60 0

These slates are sold by the ton, and have a quaint rustic appearance Obtainable from Davies Brothers, Port Madoc, North Wales

Westmoreland Slates

Tilberthwaite Green Slate Co, Kendal, Westmoreland

Names	Size	Number of squares covered by 1 ton at 3 in lap	Price per ton in truck at Coniston	Price per ton delivered in London
	in long	Sqs	£ s d	£ s d
Dark Green —				
Best selected	12 to 26	2·70	4 10 0	5 10 0
Seconds selected	12 „ 24	2·07	3 10 0	4 10 0
Best Peggies selected	9 „ 12	2·43	3 10 0	4 10 0
Second Peggies	6 „ 9	2·07	2 5 0	4 5 0

The railway rate to London is 14s 2d per ton in 5 ton lots if by sea only 10s per ton Five per cent discount is allowed off the prices quoted at Coniston

Wages

		s d
Wages slate mason s	per hour	0 10½
„ slater s	„	0 9½
slater s labourer		0 7

ANALYSIS

for sale and exportation

Green slates are from Whitland Abbey (near Narberth,

Pembrokeshire), and Westmoreland (The Tilberthwaite Green Slate Co, Kendal), as well as from Cumberland (Buttermere, from the quarries in Honister Pass), and Lancashire (Coniston) Westmoreland slates are always sold by the ton, and have different nomenclature and irregular sizes from Welsh slates When laid, the courses are not uniform in depth, but diminish towards the ridge

Other slates come from Cornwall, from the Old Delabole quarries, near Camelford Leicestershire, Rutlandshire, Northamptonshire, &c, also yield slates Of late years, a great many have been imported from the United States, chiefly because of the long strike among the Welsh quarrymen, and American slates are becoming more popular Their price in this country is 9*s* per 1,200 cheaper than the best Welsh qualities The Continent also now imports

The very [illegible] ons, are called [illegible] ht, while tho [illegible] s," and sold by number

Tho trade "thousand, or "long tally,' equals 1,200 for buying and selling, but, allowing 5 per cent for breakages, 1,260 are put into tho trucks at the quarry, and into vessels at tho ports, but tho 1,260 are carried at the same rate as if 1,200 Small numbers are sold by the "hundred," which equals 120 for buying and selling In London, slating is frequently sub let by the contractor The special rates of the railway companies are for not less than 4 ton lots, and they *carry by actual, not computed, weights*

/ *Nails* —Composition nails are best for all good work, as they are stiff and tough They are cast from an alloy of 7 copper to 4 zinc, and have a yellow, brassy appearance Copper nails are either cast or wrought, but they are soft and dear, though practically imperishable Malleable iron nails are frequently used, dipped while hot in boiled linseed oil to preserve them from corrosion These can also be painted or galvanised Cast iron nails are only employed for temporary work Zinc nails are very soft, and liable to bend, and as their heads come off in driving they make a good deal of waste

All these nails are sold by weight, and the price should lessen with the increase of length Allow 10 per cent for waste in reckoning the number to the square

Nails for small slates such as Doubles, &c, should be	$1\frac{1}{4}$ in long
Nails for medium slates such as Countesses &c, should be	$1\frac{1}{2}$ in "
Nails for large slates, such as Duchesses &c, should be	2 in "

Weight of Slating Nails

Nails	Weight per Thousand			Number per Pound		
	1½ in	1¾ in	2 in	1½ in	1¾ in	2 in
	lbs	lbs	lbs	No	No	No
Composition	$6\frac{1}{10}$	7	10½	164	144	96
Copper	5¾	7	11⅓	190	145	90
Malleable iron	5½	6¾	8½	180	150	100
Zinc	3½	4½	8½	280	220	90

Labour —The labour in holing slates any size is usually estimated at 5*s* per 1 200 but if a single slate holing machine is used a smart boy at 4½*d* per hour will be able to hole from 300 to 400 slates in an hour equivalent to 1*s* per 1 000

The following statement shows the labour required per square which will be less for larger surfaces as the slating will be performed more quickly The difference in time for the various kinds represents the extra trouble in handling greater areas being covered with larger slates in a given time as the labour in holing is the same for all sizes

A slater and labourer will lay

1 square of	Doubles (with two nails each) in	3½ hours
	Ladies	2½
	Countesses	2
	Duchesses	1½

A slater and labourer will prepare and lay —

1 square of	Doubles (with two nails each) in	4½
	Ladies	3½
	Countesses	3
	Duchesses	2½

Preparing means sorting marking and holing

Plastering against underside of slating per yard super in ½ hour

A standard quantity as laid down by the trade unions is 3 squares (any size slates) per day = 3 hours slater and labourer per square

Cost per Square —Taking Countess slates 20 in long × 10 in wide the gauge if centre nailed would be—

$$\frac{\text{Length of slate} - \text{lap}}{2} = \frac{20 \text{ in} - 3 \text{ in}}{2} = 8\tfrac{1}{2} \text{ in}$$

In estimating therefore the number of slates required per square of 100 ft super the width of the gauge in inches multiplied by the breadth of the slate in inches gives the margin or exposed surface of a single slate This divided into the number of superficial inches in a square (100 ft

super × 144 sq in = 14,400 super inches per square), will give the number of slates to a square—*e g*, $8\frac{1}{2}$ in gauge × 10 in breadth of slate = 85 sq in margin, and—

$$\frac{14\,400 \text{ super inches per square}}{85 \text{ sq in margin per slate}} = 170 \text{ Countess slates per square}$$

Allowing 5 per cent for waste, this would give roundly 180 slates to the square

As there are two nails per slate, the number of nails required per square will be found by doubling the number of slates—*i e*
cent waste f
some 374 U
to the pound
per square, as they are sold by weight

The price of good quality Port Madoc Countess slates was recently £8 per M of 1,200 at the port, and to this add loading expenses (per rail or per vessel, 1*s* 6*d* per ton on all slates), rail to London (12*s* 6*d* per ton), and delivery on site, bringing the total up to about £10 delivered Thus—

PRICE AS DELIVERED	£	s	d
Cost of 1 200 at Welsh port	8	0	0
Loading trucks 1 200 = 2 tons at 1*s* 6*d*	0	3	0
Carriage to London 2 tons at 12*s* 6*d*	1	5	0
Unloading trucks and cart	0	3	0
Cartage in London say 2 miles at 1*s* per ton per mile	0	4	0
Price delivered on site	9	15	0

Trade terms are $2\frac{1}{2}$ per cent discount for cash, or acceptance at three months The analysis of Countess slating per square would then be —

PRICE AS LAID	£	s	d
180 first quality Countess slates laid to 3 in lap at £9 15*s* per 1 200 delivered	1	9	3
$2\frac{1}{2}$ lbs of $1\frac{1}{2}$ in composition nails at 8*d* per pound	0	1	8
Labour preparing and laying 3 hours slater ($9\frac{1}{2}d$) and labourer (7*d*) at 1*s* $4\frac{1}{2}d$ per hour	0	4	1
	1	15	0
Add 20 per cent profit &c	0	7	0
Total price per square	2	2	0

Laths boarding, felting, &c, are taken in Carpenter

If the foregoing is sub let to a slate merchant, it can be

done for 35s to 38s per square, as the latter buys his slates at the quarries in large quantities, conveys them by sea, and regularly employs slaters

Countess Slates —The habit of specifying Countess slates keeps up their price compared with others, and 2s per square may sometimes be saved by stating another convenient dimension

Influence of Carriage —Although "bests" are higher in price than "seconds," and "seconds" than "thirds," at quarry, there is not very much difference in the three when put *on roof complete* (except if used in the locality of the quarry), for the difference in the cost of carriage of the three qualities makes them nearly equal in price by the time they arrive at their destination Take an instance 24 in × 14 in "best" blue or red Penrhyn slates are 65 cwt computed weight of 1 200 pieces, whereas "thirds" quality, same size, are computed at 120 cwt, inferior quality being heavier This shows the difference in weight of the two thicknesses to be nearly doubled Taking an average of all sizes, about 3s per square would be the actual difference in total cost as "laid on roof"

Leave Slating Perfect —A costly item to be remembered

guess, but say 6d per square up to 1s per square for small roofs

Circular Slating is valued in the same way, but the slates are necessarily smaller according to the radius of the curve, and they are graduated in diminishing areas from eaves to apex This requires slates of varying sizes, and an extra 5 per cent for waste in cutting to graduated shapes as well as additional labour The whole will amount to $\frac{1}{3}$ more in cost, or $\frac{1}{2}$ if the circular slating is quick sweep or small

Spaced or Half Slating will save $\frac{1}{3}$ in slates and cost $\frac{1}{5}$ less than continuous

Vertical Slating to walls is similarly calculated as for roofs, except that the labour in fixing is increased by half as much again

Torching —This is the term applied if (when the slating is laid on laths or open battens) the underside is pointed with hair mortar, of which $\frac{3}{4}$ foot cube will be needed per square It takes a bricklayer 2 hours and a labourer $\frac{1}{2}$ hour to point this area

	s	d
¾ ft cube hair mortar at 8¼d	0	5¼
2 hours bricklayer at 10½d	1	9
½ hour labourer at 7d	0	3½
	2	6
Add 20 per cent profit &c	0	6
Price per square	3	0

Plain Ridge Tile 7 in Wings, Set in Hair Mortar and Pointed with Cement —To the net cost of the ridge tile add carriage hair mortar cement labour and profit as below The tile is 18 in long at 7d each = 4½d per foot run

	s	d
1 ft ridge tile 7 in wings supplied only	0	4½
Carriage to site	0	0½
Hair mortar for setting	0	0¼
Cement for pointing	0	0½
Labour ⅙ hour slater at 9½d and labourer at 7d	0	2¾
	0	8¾
Add 20 per cent profit &c	0	1¾
Price per foot run	0	10½

From an actual job on a large building it was found to take 10 cubic feet of cement mortar 20 lbs of red paint to colour the pointing the ridge tiles being red and 170 hours of slater and his labourer for 1 000 ft run of ridging This gives about ⅙ hour slater and labourer per foot run

Make good Slating to Pipe passing through Roof —This will occupy one hour of a slater and labourer at 1s 5d and allow for an additional slate or two and nails as well as profit making say 2s 6d in all

Slate Damp proof Course has already been analysed under Bricklayer and need not be repeated

Slate Masonry —As slate masonry consists of such special work as fittings to shelving washing benches lavatory tops urinals &c which need regular machinery to execute the sawing planing rubbing sanding &c, it is always better to let this to proper slate merchants who make a special estimate for supply while the builder fixes

CHAPTER XII.—TILER.

MEMORANDA

Plain Tiles

Plain roofing tiles $10\frac{1}{2}$ in × $6\frac{1}{2}$ in × ½ in, weigh $2\frac{1}{2}$ lbs each or 20 cwt per 1 000 One square requires without allowance for waste —

If laid with	No. of Tiles	Laths, Feet Run	Lathing Nails		Pegs or Pins (1 per Tile)	Weight of Cwt [illegible]	Mortar for Bedding
			No	lb			ft cub
$2\frac{1}{2}$ in lap or 4 in gauge	551	300	255	¾	1108*	28	2
$3\frac{1}{2}$ $3\frac{1}{2}$	633	340	290	1	1266*	31	$2\frac{1}{2}$
$4\frac{1}{2}$ 3	739	400	340	$1\frac{1}{4}$	1478*	3[illegible]	3

* Or 1 peck of oak tile pins A peck = a box 8 in × 8 in × 8 in

Gauge —The gauge is otherwise known as the face or weather and it is usual to lay with a $3\frac{1}{2}$ in lap giving $3\frac{1}{2}$ in gauge

Load —A load = 1 000 plain tiles = 20 cwt 1 ton

Laths —500 ft run of plain tile laths in 5 ft 4 ft or 3 ft lengths make one bundle and one bundle of laths is frequently reckoned to the square 30 bundles = 1 load

Waste —For waste allow $2\frac{1}{2}$ per cent for tiles and 10 per cent for laths nails and pegs

Pan Tiles

Pan roofing tiles $13\frac{1}{2}$ in × $9\frac{1}{2}$ in × ½ in weigh $5\frac{1}{2}$ lbs each or 47 cwt per 1 000 One square requires, without allowance for waste —

150 tiles if laid to 12 in gauge
164 11
180 10
1 bundle of 12 laths each 10 ft long
$1\frac{1}{2}$ hundred of sixpenny lathing nails

Broomhall Tiles

Broomhall roofing tiles ordinary size $12\frac{1}{2}$ in $\times$ $9\frac{1}{2}$ in weigh $4\frac{1}{2}$ lbs each or 40 cwt per 1 000 One square requires without allowance for waste —

> 162 tiles ordinary size if laid to a $3\frac{1}{2}$ in lap or 9 in. gauge
> 330 small , ,
> 1 patent peg for every tile
> 1 galv 3 in nail for every upper tile (half the number of tiles)
> Battens 3 in $\times$ 1 in or 3 in $\times$ $\frac{3}{4}$ in

PRICES

		s	d
Plain Broseley tiling laid to $3\frac{1}{2}$ in gauge including fir laths and galvanised iron pegs	per square	58	0
Ditto ditto if oak are used add		4	0
add for laying in hair mortar		3	10
in cement		5	0
add ...		6	0
... ctiva laths			
		8	0
... bour nails			
ar u t e pins and 20 new tiles per square		21	0
Plain weather tiling $3\frac{1}{2}$ in weather on upright wall bedded and pointed in hair and ash mortar each tile to be secured with two nails		56	0
Pointing to verge of plain tiling	per ft run	0	1
Double course at eaves		0	$4\frac{1}{2}$
Extra on plain tiling for tile and a half to verges		0	?
Cutting to ridge or verge of plain tiling		0	2
Cutting to hips and valleys of plain tiling		0	3
Barge or verge in hair and ash mortar		0	$2\frac{1}{2}$
in cement		0	4
Filleting with hair mortar up to 2 in wide		0	$1\frac{1}{2}$
with Portland cement		0	2
Ridge and hip tiles and bedding in hair and ash			
		0	8
		0	10
		0	2
	,	0	6
mortar		0	10
Ditto ditto in cement		1	0
Double plain tile creasing in hair and ash mortar		0	6
in cement		0	8
	each	1	6
		1	0
		1	6
		0	3
	per square	25	3
		3	6
		5	0
		5	6
		2	0

		s	d
Relaying old pan tiles, including labour, laths and		--	0
			2½
			9
			6
			0
			6
			4

Materials

(WITHOUT PROFIT)

		s	d
	per 1,000	32	6
		43	2
	"	45	8
	"	85	0
	"	41	0
	"	270	0
	each	0	6
Ditto, 7 in wings, ditto	"	0	7
Tile finials, prime cost	"	10	0
Fir laths for plain tiles, 2 in × ⅜ in	per 100 ft run	1	6
" " 1¼ in × ½ in	"	0	9
" " 1¼ in × ⅜ in	"	0	8
" " 1 in × ⅜ in	"	0	7
Lathing nails, cut clasp, 1¼ in	per lb	0	1½
Cast iron tiling pegs, 2 in long (25 lbs per 1,000)	per cwt	9	6
" " galvanised (")	"	18	0
Oak pegs or pins	per bushel	2	0
	per 1,000	70	0
	per bundle	3	6
	per 100	0	8
	per 1 000	35	0
Tile pegs for ditto		11	0
Tile nails galvanised	"	5	6
Broomhall ridge tiles	per pair	1	5
" hip tiles	each	1	2
Cement, Portland	per bushel	1	6
Lime ground, grey chalk	"	0	9
Hair grey lime mortar	per ft cube	0	8½

Wages

		s	d
Wages, tiler's	per hour	0	9½
" tiler's labourer	"	0	7

ANALYSIS

Tiles —Tiles, in shape, are of two main classes those

patented, but few … owing to difficulties of … uble of fitting them to … crown tiles are such as have a rectangular form and plane surface A statute is supposed to regulate their size, but they are generally $10\frac{1}{2}$ in long $6\frac{1}{2}$ in broad, and $\frac{1}{2}$ in thick, with two holes in them, through which oak pins are inserted to hang upon the laths Sometimes cast iron pegs are used instead, or frequently extra large flat headed wrought nails, made of pure zinc or zinc and copper, which have the advantage of … e roof by … the nails … projecting nibs cast on in lieu of pegs, or they may be both holed and nibbed, so that if the nib is broken off the tile may be nailed In use, one tile laps over another, and that part which then appears uncovered is called the gauge of the tiling—likewise known as the face or weather Many tilers have a practice, when plain tiles are set in mortar, not to peg more than one hole in ten, or sometimes only every third or sixth course is nailed This is bad, as with the decay of the mortar the tile will slip down For walls, battens nailed or plugged to …

usually includes the lathing But the system of measurement is the same

Laths and Pegs —Laths or battens are of different sizes, but for good work they should never be less than $\frac{3}{4}$ in thick Oak laths are occasionally employed, but fir ones are generally used, nailed to each rafter The latter are imported ready sawn in various dimensions, but may be bought at the sawmills out of converted common stuff, usually in 10 ft lengths, at the following rates —

Fir laths	2 in	× $\frac{3}{4}$ in	cost 1s 6d	per 100 ft	run
	$1\frac{1}{2}$	× 1 „	„ 0s 9d	„	„
	$1\frac{1}{2}$ „	× $\frac{3}{4}$ „	„ 0s 8d	„	„
	1	× $\frac{1}{4}$ „	„ 0s 7d	„	„
Oak tiling laths			4s 6d	400	

The gauge of the laths is the same as that of the tiles, and the number of laths and nails required per square is shown in the table in Memoranda

Oak pegs cost 2s per bush l and a ... or ½ bushel Cast-iron pegs are ... about 2 in long One thousand ... at the rate of 9s 6d per cwt or 15s ... may be readily valued by allowing 2 p...

Allow 10 per cent waste on laths and p...

Labour —The time below indica...

		h m
Fixing laths	per square	[illegible]
Painting laid dry	"	[illegible]
pointed inside	"	[illegible]
outside	"	[illegible]
both sides	"	[illegible]
Plain tiling laid to 4 in gauge	"	[illegible]
3½	"	[illegible]
3		[illegible]
Loading or unloading tiles	per tho sa...	[illegible]

Cost per Square —Taking plain Brose... 6½ in laid with the usual lap of 3½ in ... 3½ in gauge or face the number needed per sq ... be 633 (found by the same rule as slates) and ... per cent for waste the quantity for estima...

Of lathing 340 ft run will be wanted as ... 12 in apart and reckoning 10 per cent waste the ... fixed would be about 374 ft

The calculated number of nails is 289 plus 10 per ... waste equals 317 or 1½ lb of 1½ in cut clasp nails ...

If cast iron pegs are specified the number requ... twice the quantity of tiles in this case 1 266 or ... allowing 10 per cent for waste And as 1 000 p... 25 lbs the weight would be 35 lbs to the square

Price as Delivered

		s	d
[illegible]	per 1 000	2	[illegible]
[illegible]		7	[illegible]
[illegible]		0	7
[illegible]		2	0
[illegible]		0	7
Price delivered on site		43	2

Price as Laid

	£	s	d
690 plain Broseley tiles at 43s 2d per 1 000 delivered	1	8	[illegible]
3 4 ft run 1½ in. × ⅜ in laths at 6d per 100 ft run	0	[illegible]	[illegible]
317 or 1½ lb of 1½ in cut clasp nails at 1½d per lb	0	0	1½
Carried forward	1	10	8½

CHAPTER XIII.—THATCHER.

MEMORANDA

[illegible] system of thatching and terms used vary with the [illegible] thatch is generally laid in sheaves on fir battens [illegible] ords [illegible] ter [illegible] ch [illegible] rles [illegible] e straw is best but wheat straw is usually [illegible] straw are inferior Straw should be bright [illegible] s and rushes are also used in some places [illegible] w last 15 to 20 years barley and oat

Cost per Square.—Taking [illegible] 6½ in., laid with the usual lap [illegible] 3½-in gauge or face, the number [illegible] be 633 (found by the same [illegible] per cent for waste, the quar[illegible]

Of lathing 340 ft run [illegible] 12 in. apart and reckoning 10 per cent wa[illegible] fixed would be about 374 ft.

The calculated number of nails is 2-3, [illegible] waste equals 317, or 1¼ lb of 1¼ in. cut clasp [illegible]

If cast iron pegs are specified, the number [illegible] twice the quantity of tiles, in this case 1,266 [illegible] allowing 10 per cent for waste. And as 1000 [illegible] 25 lbs, the weight would be 35 lbs to the square.

STRAW

	[illegible] per load	cwt. per load
	324	11 [illegible]
	378	11 [illegible]

= 3½ lbs av [illegible]
= 41½ y c
= 15½ y c
[illegible] lbs

PRICE AS DELIVERED

	Per 1000
Broseley tiles at local station (net trade price)	
Railway rate to Paddington in 5 ton lots	
Loading carts 1 hour labourer at 7*d*	
Cartage from Paddington to site say 2 miles at 1*s*	
Unloading carts 1 hour labourer at 7*d*	
Price delivered on site	
	43 2

[illegible] in thickness [illegible] baked roofing [illegible] all thatch

PRICE AS LAID

	£	s	d
650 plain Broseley tiles at 43*s* 2*d* per 1000 delivered	1	8	0
374 ft. run 1¼ in. × ¾ in laths at 8*d* per 100 ft run	0	2	6
317 or 1¼ lb of 1¼ in. cut clasp nails at 1½*d* per lb	0	0	1
Carried forward			

					[illegible]	[illegible]
St Petersburg Standard, if reduced to $2\frac{1}{2}$ in, thick				= [illegible]	= [illegible]	
"	"	"	2	"	= [illegible]	= [illegible]
"		"	$1\frac{3}{4}$	"	= 1,2[illegible]	= [illegible]
"	"	"	$1\frac{1}{2}$	"	= 1,[illegible]	= [illegible]
"	"	"	$1\frac{1}{4}$	"	= 1,[illegible]	= [illegible]
	"	"	1	"	= 1,[illegible]	= [illegible]
"	"	"	$\frac{3}{4}$	"	= 2,[illegible]	= [illegible]
"	"	"	$\frac{1}{2}$	"	= [illegible]	= [illegible]

Market Forms of Timber

Timber.—A tree is not considered to be "timber" unless the trunk is 24 in girth

Logs are trunks of felled trees with the branches lopped

Balks are obtained by roughly squaring the logs

Hand masts are the longest, soundest, and straightest trees after being topped and barked The term is technically applied to those of a circumference between 24 in and 72 in They are measured by the hand of 4 in, there being also a fixed proportion between the number of hands in the circumference [illegible] than 24 in at the base

Inch masts are those having a circumference of more than 72 in, and are generally dressed to a square or octagonal form

Balk timber, or *square timber*, consists of the trunk hewn square, generally with the axe but sometimes with the saw

Deal is the general term given to fir timber when cut into small dimensions for building purposes In this form it comes into the market sawn into different widths known as "planks" "deals," and "battens," varying from 1 to 4 in thick but principally 3 in, and in lengths from 8 to 20 ft, but chiefly 12 ft There is however no strict classification, and of late years all sorts of intermediate sizes have been imported

Planks are 10 to 18 in wide but chiefly 11 in × 3 in

Deals are 8 to 9 in wide, but chiefly 9 in × 3 in thick

Battens are 4 to 7 in wide but chiefly 7 in × 3 in thick

Ends are bits of plank deal or batten less than 8 ft long

Scaffold and *ladder poles* are from young trees of larch or spruce They average about 33 ft in length and are classed according to the diameter of their butts

Rickers are about 22 ft long and under $2\frac{1}{2}$ in diameter at the top end

Timber How Sold

Fir American pine greenheart oak ash elm teak and pitch pine are sold by the load of 50 ft cube when in log or balk—sometimes caliper, and sometimes string measure

Wainscot in London at per 18 ft cube logs, but at per cubic foot at most other ports

Cedar and mahogany at per foot super, of inch thick

Planks deals and battens are usually sold in London by the six score long hundred or standard hundred (120 pieces) reduced to the St Petersburg standard

Flooring and matched and grooved boarding by the reputed or customary square

Beads mouldings skirtings and weather boards by the 100 ft run

Battens for slates or tiles by the 144 f r (brokers) or 100 f r (merchants)

Plasterers laths at per bundle of 360 ft to 500 ft run

Lathwood at per cubic fathom of 6 ft × 6 ft × 6 ft = 216 f c

Weights of Timbers

Pine Wood

Name	Weight per f c	F C per ton
Fir Baltic	35 lb	64
Fir Norway spruce	30	75
Larch	35	64
Pine Northern Memel	36	62
Riga	34	66
pitch	46	49
red American	36	67
white	28	80
yellow	26	86
kauri New Zealand	38	59

Hard Wood

Name	Weight per f c.	F C. per ton
Ash	45 lb	41
Beech	42	53
Blue gum	53	42
Chestnut	38	59
Ebony	*80*	28
Elm	37	61
Greenheart	60	37
Hornbeam	53	42
Jarrah	51	44

Name	Weight per f c	F C per ton
Lignum vitæ	80 lb	28
Mahogany, Honduras	42 ,,	53
,, Spanish	53 ,,	42
American maple	47 ,,	48
Oak, American white	53 ,,	42
,, Dantzic	48 ,,	47
,, English	55 ,,	41
Sycamore	37 ,,	61
Teak	46 ,,	49
Walnut, black	60 ,,	37
,, white	58 ,,	39

Waste in Converting Timber into Scantlings

White pine logs	20 per cent	Greenheart	30 per cent
Northern pine	23 ,,	Spanish mahogany	30 ,,
Pitch pine	25 ,,	Honduras ditto	31 ,,
Teak	29 ,,	English elm	34 ,,
American white oak	30 ,,	English oak	35 ,,

5 cubic feet per load, or $\frac{1}{10}$th, are usually allowed for waste in sawing fir and pine into planks

An allowance of $\frac{1}{3}$ to $\frac{1}{2}$ is generally made for waste on scaffolding, gantries, centering, &c , on reconverting to use

In practice it is considered that an ordinary "Northern pine" deal, 9 in wide, will shrink in seasoning $\frac{1}{4}$ in , and a "white deal" $\frac{1}{8}$ in

Floor Tongues

410 f r hoop iron $1\frac{1}{4}$ in wide No 16 Birmingham wire gauge = 1 cwt
576 f r hoop iron $1\frac{1}{4}$ in × $\frac{1}{16}$ in No 16 Birmingham wire gauge = 1 cwt
360 f r hoop iron $1\frac{1}{2}$ in × $\frac{1}{16}$ in No 16 Birmingham wire gauge = 1 cwt
A bundle of hoop iron $1\frac{1}{2}$ in × $\frac{1}{16}$ in contains 180 ft , and weighs $\frac{1}{2}$ cwt

Miscellaneous

A knot of sash line = 12 yards = 36 feet

1,000 cleft oak shingles, with 4 in weather will cover 100 ft sup and will require 5 lbs of $1\frac{1}{4}$ in nails, or 700 shingles with 6 in face ditto Usual size 12 or 18 in long × 3 to 6 in wide × $\frac{1}{4}$ in thick

There are 3 000 000 acres of woodland in the British Isles.

To measure round tapering timber –

$$\frac{(\frac{1}{4}\text{ middle girth in inches})^2 \times \text{ft run in log}}{144} = \text{cubic feet in log}$$

PRICES

Timber in Scantling.—(Supplied Only.)

		s	d
Ash, English	per ft cube	4	9
Elm, English	"	4	6
Oak, English	"	6	6
Yellow pine	"	4	6
Pitch pine		3	0
Teak, Moulmein		9	0
Mahogany, Honduras		9	0
Mahogany, Spanish		12	0
Walnut, American		11	0
Baltic fir in balk delivered on site		3	0
in deals		2	0
mixed		2	4

Timber Fixed but not Framed

		s	d
Fir under 144 sq in in section, rough	per ft cube	2	11
wrought		3	5
Fixing only foregoing, labour and nails		0	6
Oak in sleeper plates, rough		6	9
in curbs, rough		7	0
planed and rebated		7	6
Creosoting fir in vacuum at 8 to 10 lbs to the cubic foot (creosote applied hot at a pressure of at least 100 lbs per sq inch) including carriage		0	9

Timber Framed and Fixed

		s	d
Fir under 144 sq in in section, rough	per ft cube	3	7
wrought		4	6
Framing and fixing only foregoing, rough		1	0
wrought		1	5
Proper fir door frames wrought, framed, rebated, chamfered or beaded and fixed		5	8
Ditto in double rebated transoms ditto		6	6
Pitch pine under 144 sq in in section, rough		4	0
wrought		5	0
Oak under 64 sq in in section, rough		7	9
wrought		9	0
Add to timber when put together with white lead		0	2
Hoisting trusses for every 10 ft above 30 ft		0	9

Timber Piles

		s	d
Fir piles, log or balk, including planting in position	per ft cube	2	3
Fir in sheet or small piles under 9 in square, ditto		2	9
Driving whole piles, portion in ground only to be measured (tide work add 50 per cent)		1	0
Driving sheet or small piles 9 in square and ditto		1	3
Heading and pointing whole piles where rings and shoes are not required, including cutting off heads after driving	per pile	2	6

		s	d
Ditto where rings and shoes are required including nails and fitting and fixing shoes or rings	per pile	5	0
Allowance for bringing erecting and removing pile engine and tackle &c for driving	per job	20	0

Architraves

5 in × 1¼ in moulded architrave and fixed	per foot run	0	5
4½ in × 1¼ in		0	4½
3 in × 1 in wrought and chamfered architrave and fixed		0	3½
Mitres per inch girth of architrave		0	0½
2 in wrought and chamfered blocks or plinths up to 9 in high and fixed	each	0	9

Battens and Fillets

Deal battening 2 in × ¾ in spaced for Counters	per square	6	9
	"		6
	per foot run	0	0¾
		0	1

Description	½ in		¾ in		1 in		1¼ in		1½ in		2 in	
per ft run	s	d	s	d	s	d	s	d	s	d	s	d
Deal fillets rough 1 in wide s o	0	0⅛	0	0¼	0	0¼	0	0¼	0	0¼	0	0¼
Do 2 in	0	0¼	0	0¼	0	0¼	0	0¼	0	0¼	0	0½
Do 3 in	0	0¼	0	0¼	0	0¼	0	0½	0	0½	0	0¾
Do wrought 1 in do do	0	0¼	0	0¼	0	0¼	0	0¼	0	0¼	0	0½
Do do 2 in do do	0	0¼	0	0½	0	0½	0	0¾	0	0¾	0	1
Do do 3 in do do	0	0½	0	0¾	0	0¾	0	1	0	1	0	1¼
Add for each angle if bevelled chamfered or rounded	0	0¼	0	0¼	0	0¼	0	0¼	0	0¼	0	0¼
Add if framed	0	0½	0	0¾	0	1	0	1	0	1	0	1¼
Add nails labour fixing and profit	0	0½	0	0½	0	0½	0	0¾	0	0¾	0	1

		s	d
4 in × 1 in rough feather edge tilting fillet and fixed	per ft run	0	2

Add to fillets if bent circular one fourth foregoing rates
For oak fillets double
For mahogany or teak fillets treble

Bracketing

1 in rough deal bracketing to cornices	per ft sup	0	8
1¼ in		0	9
Angle brackets to ditto	each	0	11
Bracketing to soffits of eaves or round girders &c	"	0	4

Machine-prepared Boardings.

Of Deal in Batten Widths		¾ in		1 in		1¼ in	
		s	*d*	*s*	*d*	*s*	*d*
Rough, supplied only, at docks,	per square	11	0	13	0	15	0
,, ,, on site	,,	13	0	15	4	17	6
Ditto, nails, labour, and profit only, in fixing	,,	6	6	7	0	7	6
Ditto, and fixed complete in roofs	,,	19	6	22	3	25	6
Ditto, traversed for lead or zinc, and firring to falls	,,	26	9	29	6	32	0
Add if edges shot	,,	1	0	1	3	1	6
,, wrought one side	,,	1	8	1	8	1	8
,, ,, both sides	,,	3	0	3	0	3	0
,, ploughed and tongued, or rebated	,,	3	0	4	0	5	0
,, on curved surfaces	,,	2	6	3	0	4	0
,, in ceilings and fixed from beneath	,,	1	6	1	9	2	0
Add for raking cut and waste to hips and valleys	per ft. run	0	1	0	1¼	0	1½

Machine prepared Matchboardings.

		¾ in		⅞ in		1 in	
		s	*d*	*s*	*d*	*s*	*d*
Yellow deal matchboarding, firsts, supplied only, at docks	per square	13	0	15	0	18	0
Ditto, ditto, on site	,,	15	0	17	0	20	0
Ditto nails labour, and profit, only, in fixing	,,	5	0	5	6	6	0
Ditto, and fixed complete .	,,	21	0	23	6	28	6

Deal Boarding.

For small quantities up to ½ square

Description		¾ in		⅞ in		1 in.		1¼ in		1½ in		2 in	
	per ft. sup	*s*	*d*	*s*	*d*	*s*	*d*	*s*	*d*	*s*	*d*	*s*	*d*
Rough, supplied only on site including profit	,,	0	2½	0	3	0	3½	0	4	0	4½	0	5½
Add if edges shot	,,	0	0½	0	0½	0	0½	0	0¾	0	1	0	1½
,, wrought one side	,,	0	0½	0	0½	0	0¾	0	0¾	0	1	0	1
,, ,, both sides	,,	0	1	0	1	0	1½	0	1½	0	2	0	2
,, if ploughed and tongued	,,	0	0¾	0	0¾	0	1	0	1	0	1¼	0	1½
,, framed or clamped	,,	0	3	0	3	0	3¼	0	3½	0	3½	0	4
,, fixed and cut to size	,,	0	1	0	1	0	1½	0	1½	0	2	0	2½
,, hung (exclusive of hinges and screws)	,,	0	1	0	1	0	1¼	0	1¼	0	1½	0	2

		s	d
	per ft super	0	7
	per ft run	0	3
		0	5
	each	2	6
[illegible]	[illegible] aight	Curved work &c	

Treble the foregoing deal prices for mahogany or teak

Centerings and Casings

Prices are for first use including supports casing and striking For every subsequent use on the same work take one third of the prices below —

		s	d
Use of straight centering to vaults arches &c	per square	28	0
[illegible]		16	10
[illegible]	per ft run	0	6
[illegible]		0	6
[illegible]		0	3
[illegible] 9 in		0	5
Use and waste of casings for concrete walls straight on plan and removal	per yd sup	1	10
Use and waste of casings curved on plan and removal		2	3
Add if in narrow widths up to 30 in for jambs &c	per ft sup	0	3
Yellow pine pattern for cast iron hollow column 5 in mean external diameter of ⅞ in metal 8 ft [illegible]			
[illegible]	each	35	6
		5	0

Doors and Gates

Including labour in hanging and fixing only the hinges

Description		1½ in s	1½ in d	1¾ in s	1¾ in d	2 in s	2 in d
Deal door 4 panel framed square and flat	per ft sup	1	1	1	2	1	3
flush square and flat		1	2	1	3	1	4
6 panel framed square and flat		1	3	1	4	1	5
[illegible] square and flat		1	4	1	5	1	6
Add if [illegible] separated by a bead or hung folding in two leaves	per ft sup	0	1	0	1½	0	2
Add if square and flat framing if stop chamfered for each side	per ft sup	0	1	0	1½	0	1½
Add to square framing if moulded 4 panel doors [illegible] each side	per ft sup	0	1½	0	1½	0	2

DOORS AND GATES—*continued*

Description	1¼ in.		1½ in		2 in	
	s	*d*	*s*	*d*	*s*	*d*
Ditto 6 panel doors ditto per ft sup	0	1½	0	2	0	2½
Sash door with lower panels framed square and flat and the upper portion framed as a sash with diminished stiles and [illegible]	1	1	1	3	1	5
[illegible] sup	1	0	1	2	1	4
Add if braced	0	1½	0	2	0	2½
Add if hung in two leaves folding	0	1	0	1½	0	2
Framed and braced doors and gates wrot ploughed tongued and beaded or rebated and beaded or V chamfered ¾ in or ⅞ in battens per ft sup	1	2	1	4	1	7
Add if prepared with a wicket including hanging the wicket per wicket	6	0	7	0	8	0
Add to all doors if put together with white lead per ft sup	0	0½	0	0¾	0	1

Add 25 per cent if doors of pitch pine instead of deal
For English oak doors double the prices for deal ones
For Honduras mahogany doors thrice prices of deal

FLOORS

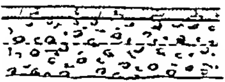
Laid complete with straight joints and splayed headings Floors to have 2 nails in each board to every joist punched and puttied —

Description	1¼ in		1½ in		2 in	
	s	*d*	*s*	*d*	*s*	*d*
Yellow deal wrought 6 to 7 in batten floor edges shot and thicknessed per square	31	0	34	0	41	0
Ditto ploughed and tongued or rebated and filleted per square	34	6	38	0	45	6
Ditto and tongued with hoop iron 1¼ in × $\frac{1}{16}$ in painted in red lead 2 cts per square	37	0	41	0	49	0
Deduct if in 4 to 4½ in widths	4	0	4	0	5	0
S[illegible] *yellow deal floor in 4 to 4½ in* widths (as sketches) wrought rebated and filleted The fillets to be 1 in × ¼ in and the fillets and edges of boards to be coated with white lead and each board to be cramped up singly till						

FLOORS—*continued*

Description	1¼ in		1½ in		2 in	
	s	*d*	*s*	*d*	*s*	*d*
the white lead squeezes out at top The concrete bed to be spread over with a layer of pitch and tar ½ in thick in the proportion of 1 cwt of pitch to 7½ gals of coal tar boiled together for at least one hour so that when cold it may be elastic and tough (price exclusive of concrete and wood joists) per square	60	0	64	0	70	0
Pitch pine floor as per sketch the boards to be in 4½ in widths wrought rebated and filleted the fillets being 1 in × ½ in The fillets and edges of the boards to be coated with white lead and each board to be cramped up singly till the white lead squeezes out at the top per square	55	0	60	0	68	0
Add to all flooring if copper nails are used instead of iron ones per square	5	0	7	0	10	0
Add to all floors if prepared and laid with tongued headings per square	1	0	1	3	1	9
Glued and mitred border 3 in wide to yellow deal floor and sinking per ft run	0	5	0	6	0	7
Extra to forming sinking for mat 3 ft. × 2 ft in deal floors each	5	0	6	0	8	0

Section of Joists



Section of Floor

[illegible] Flooring on Concrete

Pitch pine rebated and filleted Floor

Oak Floors

Description	1¼ in		1½ in		2 in	
	s	*d*	*s*	*d*	*s*	*d*
Wrought edges shot and fillistered per square	75	0	90	0	110	0
Ditto ploughed and tongued or rebated and filleted with oak tongues or fillets	[illegible]	0	110	0	130	0
		0	113	0	134	0
		0	13	0	15	0
Ditto if copper nails are used instead of iron ones in oak floors per square	10	0	12	0	15	0

Wood Block Flooring

Laid complete (exclusive of concrete base) Prices are for quantities not less than 200 yards super, ordinary pattern

		1½ in		2 in	
		s	*d*	*s*	*d*
Red or yellow deal	per yd sup	6	6	7	6
Pitch pine	,,	7	0	8	0
Oak wainscoat	,,	12	6	14	6
Walnut or teak	,,	14	6	16	6
American maple	,,	8	6	10	0
Acme wood block flooring 12 in × 2¾ in × 1½ in of pitch pine, laid on bituminous composition	,,	7	6	9	0
Ditto, ditto yellow deal ditto	,,	7	0	8	6
Straight cutting and waste, soft woods	per foot run	0	3	0	4
,, ,, hard woods	,,	0	9	0	11

Parquet Floors

Laid complete (exclusive of base) Prices are for quantities not less than 500 ft super, and including wax polishing

PARQUET FLOORS—*continued*

		¾ in		1 in solid	
		s	*d*	*s*	*d*
Oak filling plain pattern average prices	per ft sup	1	8	2	8
border	„	2	2	3	0
Borders of oak round hearths 3 to 4 in wide and ¾ to 1 in thick wrought and mitred including sinking floor for same and fixing	per ft run			0	9
Dowels of oak as for floors 2 in long × ¼ in diam including holes	each			0	0¼

SOUND BOARDING AND STRUTTING

¾ in sound boarding including 1½ in × 1 in deal fillets each side of joists	per square	2	2
Ditto ditto with edges shot		26	3
Sawdust filled in 4 in thick	per yd sup	1	0
2 in × 1½ in herring bone strutting to 11 in joists and nailed	per ft run	0	4¾
Solid ditto exceeding 9 in deep		0	5½
Pugging to floors with coarse stuff and chopped hay 3 in thick the net quantity between joists being measured	per yd sup	0	9

ROLLS

2 in deal roll for lead and fixed	per ft run	0	2¾
birdsmouthed and ditto		0	3½
Mitres to ditto one intersection	each	0	2¼
two hips with ridge		0	5
Splayed ends to rolls		0	1

PARTITIONS

Description	1 in		1¼ in		1½ in.	
	s	*d*	*s*	*d*	*s*	*d*
Deal framed square and flat panel per ft sup	0	10	1	0	1	2
Deduct if left rough on one side	0	1	0	1	0	1
Add if moulded on one side	0	1	0	1¼	0	1½
Add for any portion framed as a sash	0	1	0	1¼	0	1½

Framed work circular on plan flat sweep under 2 in rise to 1 ft of chord 1½ times above prices

Framed work, circular on plan, quick sweep 2 to 4 in rise to 1 ft of chord, 2 times above prices

Handrails

Framed and fixed level or raking —

Description		Deal		Oak		Mah	
		s	*d*	*s*	*d*	*s*	*d*
3 in × 3 in rounded	per ft run	0	8	1	4	1	9
4 in × 3 in moulded	"	1	0	2	0	2	6
Scrolls for handrails	each	6	0	12	0	16	0
Caps turned and mitred	"	1	6	2	9	3	6
Joint including screw and nut	"	1	0	1	9	2	0
Housing ends of 4 in × 3 in hand rail level	"	0	3	0	3½	0	4
Ditto ditto but on rake	"	0	4	0	5	0	6
Housings in handrail to receive balusters	"	0	2	0	2½	0	3

Ramped handrail is worth 2 times straight
Circular " " 2½ " "
Wreathed " " 4 " "

Labour on mahogany handrails equals 1½ times on deal

Balusters

Description		Deal		Oak		Mah	
		s	*d*	*s*	*d*	*s*	*d*
1 in turned balusters, housed and fixed 3 ft long	each	1	0	1	8	2	0
1½ in ditto ditto ditto		1	2	2	0	2	6
2 in ditto ditto, ditto	"	1	5	2	0	3	0
Turning only balusters, ordinary pattern about 3 ft long	"	0	6	0	9	1	0
Ends of balusters dovetailed	"	0	0¾	0	1	0	1¼
Dovetail mortises in steps for balusters if not otherwise taken	"	0	1	0	1½	0	2

Newels

Description		Deal		Oak		Mah	
		s	*d*	*s*	*d*	*s*	*d*
3 in × 3 in square wrought, framed and fixed	per ft run	0	8	1	3	1	8
Above 3 in × 3 in ditto	per ft cube	7	0	14	0	18	0
Turning only newels, in addition to the price as square	each	1	0	1	9	2	6
Turned pendants	"	0	6	0	9	1	0

Skirtings

	s	d
¾ in × 7 in deal torus moulded skirting and fixed per ft run	0	4
1 in × 7 in	0	4½
1 in × 9 in	0	5½
1 in × 5 in deal wrot o s square skirting fixed	0	4
1 in × 9 in chamfered	0	5
lud ng		
	0	3
each	0	4½
	0	2½
	0	3
rice of straight		

Roofing Felt

	s	d
per square	10	0
	2	5

Shelving

	s	d
1 in wrought s s shelving and brackets fixed per ft sup	0	7
1 in wrought s s louvre boards fixed to framing	0	6

Mouldings

	s	d
4 in × 1 in deal moulding machine made s o per 100 ft run	9	0
3 in × 1 in	6	0
2½ in × ¾ in	4	0
2 in × ¾ in	3	0
3½ in to 5 in girth moulding trade pattern	21	0
2½ in to 3 in	16	0
1½ in to 2 in	7	0
3-in × 2 in moulded handrail	14	6
2 in × 2 in and under special moulding and fixed per ft cube	12	0
2 in × 2 in to 4 in × 3 in	8	0
Over 4 in × 3 in	6	0

Capping

Description	Deal s	Deal d	Oak s	Oak d	Mah s	Mah d
Capping rounded or moulded not exceeding 3 in × 1 in and fixed level or raking per ft run	0	5	0	9	1	0
Ditto ditto bent in fixing	0	7	1	0	1	4
Ditto ditto circular on plan	0	10	1	6	2	0
Mitres to capping each	0	1	0	1½	0	2

SUNDRIES—*continued*

		s	d
Double or staff beading straight	per ft run	0	0½
circular		0	1½
Chamfering not exceeding 2 in wide straight		0	0¼
circular	,	0	0½
Fair ends not exceeding 3 in thick		0	0½
Flutes (each flute) any size		0	1¼
Groove or plough straight		0	0¼
circular	,	0	1¼
Moulding not exceeding 2 in girth straight		0	1½
circular	,	0	3
Rounded nosing not exceeding 2 in thick straight	,,	0	0¾
circular		0	1½
Rebating not exceeding 2 in girth straight	,	0	0¼
, circular	,	0	1¼
Scribing	,	0	0½
Sinking		0	1
Tonguing and grooving	,	0	0½
Cross tonguing	,,	0	0¾
Cross or feather tonguing including ploughing and tonguing	,,	0	2
	,	0	1
	each	0	2
	,	0	1½
	,,	0	1¼
Notches not exceeding 6-in girth	,,	0	0¼
Stops to mouldings chamfers nosings, grooves &c	,	0	0½
Turning table legs and similar articles	,,	1	1

SAWING

Hand sawing to seasoned or old Baltic pine	per square	4	5
American pine	,,	3	11
pitch pine	,,	7	0
ash beech or elm		6	2
, Honduras mahogany	,	6	2
, Baltic or American oak	,,	6	7
English oak	,,	7	11
Burmah teak	,,	8	9
Ripping down old fir or deal, not exceeding 4 in thick	per 10 ft run	0	2
Ditto oak &c	,	0	3½
Sawing battens 7 in deep	,	0	2½
, deals 9 in deep	,,	0	3½
, planks 11 in deep	,,	0	4

For machine sawing take half the foregoing rates

PLANING

Planing by hand straight (1d per f s)	per square	8	0
, ,, curved (1½d per f s)	,,	12	0
Planing by machinery, straight, 1½ in boards	,,	1	9
,, ,, , 1¼ in and under	,,	1	6

Planing on hard woods is one third more than on fir

MATERIALS

(WITHOUT PROFIT)

		s	d
Chalk dry fine powdered for felt roofing (barrels included holding 2 bushels each)	per barrel	3	6
Felt inodorous or bituminous in rolls 25 and 30 yds run × 32 in wide (weighing 3 to 4 lbs per y s.)	per yd run	0	8
Felt patent asphaltic ditto ditto	"	0	8
Felt sarking or sheathing ditto ditto		0	6
Nails for ditto iron clout 1 in long	per 1 000	1	4
Coal tar for felt roofing purified in iron drums	per gallon	0	4
Deal fillets for floors not exceeding 2 in × ¾ in	per 100 ft run	3	0
Oak		4	6
Glass paper sand or emery ditto	per ream	16	0
	per quire	0	10
	per sheet	0	0½
Glue best town made	per lb	0	9
Glue best Scotch 65s per cwt		0	7
Line worsted white or coloured for blinds	per yd run	0	0¾
Line patent sash best white Italian flax	"	0	1
Line best plaited sash flax No 6 100 strands		0	1½
Line No 8 140 strands		0	2
Pencils carpenters oval	per doz	0	8
Sawdust white deal (17 to 20 lbs per bushel)	per striked bushel	0	2½
Slag wool or silicate cotton slabs 1 in thick	per ft sup	0	1½
2 in thick		0	2½
3 in thick		0	4
Ditto extra quality 10 lbs per foot cube and 200 ft cube per ton	per ton	100	0
Ditto ordinary quality 12 lbs per foot cube and 187 ft cube per ton		80	0
Loose silicate cotton or slag wool	per cwt	5	6
Tongues for joints deal cross or feather	per 100 ft run	6	0
oak		9	0
Trenails oak ½ to ¾ in diam 5 to 8 in long	per hundred	2	0
1 in diam 6 to 9 in long		2	9
Wedges ½ in thick in centre deal	per ft sup	0	2¼
¾ in		0	3¼
1 in		0	4
1¼ in		0	4¾
1½ in		0	5½
2 in		0	6½

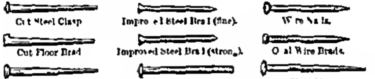
Double the above prices for oak wedges

NAILS

		s	d
Steel spike 5 in and 6 in long	per lb	0	2
7 in to 10 in		0	1¾
rosehead 1 in long		0	2½
1¼ in		0	2¼
1½ in		0	2
1¾ in		0	1¾
2 in to 2¾ in long		0	1½
3 in to 4 in		0	1¼
cut clasp 1 in long		0	2¼
1¼ in		0	1¾
1½ in		0	1¼

NAILS—*continued*

		s	d
Steel cut clasp 2 in to 2½ in long	per lb	0	1½
3 in to 5 in		0	1
wrought brads ½ in long		0	5½
¾ in		0	3½
1 in		0	3½
1¼ in		0	3
1½ in		0	2¾
2 in		0	2½
2¼ in and 2½ in long		0	2
3 in long		0	1¾
Sprig glaziers ½ in and ¾ in long		0	4
Tacks Flemish black ½ in to ¾ in long		0	6
tinned		0	8
Nails brass headed strong 1 in to 1½ in long		0	3
2 in to 3 in		0	6
Iron clout strong 1 in to 1¾ in long		0	5
2 in to 3 in		0	3
Copper various any size		1	3
Composition cast or gun metal		0	10
Wire chequered head (mixed)		0	1½



Cut Steel Clasp — Improved Steel Brad (fine). — Wire Nails.
Cut Floor Brad — Improved Steel Brad (strong). — Oval Wire Brads.
Cut Clout — Steel Rose (flat or sharp points) — Steel Clasp

SCREWS—FLATHEAD ACCORDING TO GAUGE

		Iron					Brass				
		s	d		s	d	s	d		s	d
½ in long	per gross	0	8½	to	2	0	1	6	to	4	0
¾ in		0	10		3	0	1	10		8	0
1 in		1	0½		5	0	2	9		12	6
1¼ in		1	3½		6	0	3	3		17	6
1½ in		1	6		10	6	4	0		28	0
1¾ in		1	10		15	0	5	3		42	0
2 in		2	0		38	0	6	3		50	0
2¼ in		2	5		40	0	7	0		52	0
2½ in		2	8		42	0	10	0		54	0
2¾ in		3	4		45	0	13	0		60	0
3 in		4	0		46	0	14	6		70	0

WAGES

		s	d
Wages carpenter s	per hour	0	10½
joiner s		0	10½
woodworking machinist s	,	0	10½
working foreman s		1	2
horse cart and man	,	1	5
carpenter s labourer	,	0	7

Upholsterer

		s	d
Baize any colour supplied and fixed on doors and formed into panels with brass headed nails	per f s	0	6
Blinds, venetian of seasoned pine best tapes with inter woven cross tapes lines pulleys brackets &c complete painted four coats in oil and varnished supplied and fixed		0	10
Blinds window of good quality buff brown or white holland 1½ in hem at bottom and narrow hem at top making complete and fixing (exclusive of lath roller cords &c)	per y s	1	6
		0	5
	per y.r	2	6
		0	1
ght			
	per f r	0	3
		0	3½
	per set	1	6
	each	0	4
		1	3
		0	4

Ironmongery

The following are list prices from the catalogue of a well known firm who allow about 20 per cent trade discount Add cost of screws fixing and 20 per cent builder s profit &c

Bolts

Description	3 in	4 in	5 in	6 in	8 in	9 in	10 in	12 in
	s d	s d	s d	s d	s d	s d	s d	s d
Japanned iron tower solid end each	0 2½	0 3	0 3½	0 4½	0 6	0 6½	0 7	0 8½
Ditto barrel brass knob	0 4	0 5	0 6	0 7	0 9	0 10	0 11	1 1
Bright iron square spring brass knob	0 4	0 5	0 7	0 9	1 1	1 2½	1 4	1 7
Brass barrel medium	1 6½	1 9	2 1	2 6	3 7	4 3	1 11	5 6
Ditto flush sunk slide	0 6	0 7	0 8	0 10	1 0	1 2	1 4	1 8
Ditto cup bo rl neck el strong	0 7	0 9	0 11	1 1	—	—	—	—
Jap malleable barrel door chains	—	—	0 8	0 10	1 1	1 3	1 5	1 9
Polished brass ditto ditto	—	—	4 2	6 0	7 8	9 6	12 0	17 0
Add screws only in fixing	0 0¾	0 0¾	0 1	0 1	0 1½	0 1½	0 1½	0 1½
Add labour only fixing on deal	0 3½	0 4	0 4½	0 5	0 5½	0 6	0 6½	0 7

Description	6 in	8 in	10 in	12 in	14 in	16 in	20 in	24 in
	s d	*s d*	*s d*	*s d*	*s d*	*s d*	*s d*	*s d*
H hinges wrought iron per pair	0 10	1 1	1 4	1 7	1 11	—	—	—
H L ditto, ditto per pair	0 11	1 3	1 8	2 2	2 9	—	—	—
Cross garnet or T hinges W I per pair	—	0 8	0 10	1 0	1 3	1 7	2 3	3 4
Strap hinges wrought iron per pair	0 8	0 11	1 4	1 10	2 8	—	—	—
Hook and eye ditto per pair	—	—	—	—	—	—	3 4	5 6
Add, if fixed per pair	0 4	0 4	0 5	0 5	0 6	0 7	0 8	0 9

Description	24 in	30 in	36 in	4[illegible] in	45 in	54 in	60 in
	s d	*s d*	*s d*	*s d*	*s d*	*s d*	*s d*
Collinge's patent gate hinges with spherical joints per pair	10 0	13 0	16 6	20 6	24 0	27 6	31 0
Ditto with fangs for stone piers per pair	11 0	14 0	17 6	21 6	25 0	28 6	32 0
Add if fixed	0 10	1 0	1 2	1 4	1 6	1 9	2 0
Bolts for ditto 4½*d* each							

		s d
Smith's patent floor hinges one spring and centre for one door up to 2¼ in thick	per set	39 0
Add if fixed including cutting floor	"	2 6

Hooks

Description		3 in.	4 in	5 in	6 in	8 in	10 in
		s d	*s d*	*s d*	*s d*	*s d*	*s d*
Wrought iron cabin hooks and eyes	each	0 4	0 5	0 6	0 7	0 9	0 11
Brass ditto ditto		0 7	0 9	0 11	1 1	1 5	1 9
Add if fixed	"	0 2½	0 3	0 3½	0 4	0 5	0 6
Brass single, wardrobe	"	1 0	—	—	—	—	—
Brass double wardrobe	"	1 6	—	—	—	—	—

		s d
1½ in knobs iron japanned, screw	each	0 2
" brass "	"	0 3½
" hardwood, "	"	0 3½
Add if fixed	"	0 2

Latches

		s	d
Cast iron stable-door latch 4 in	each	1	0
Iron mortise stable door latch 4½ in × 3½ in × ⅝ in		2	6
Wrought Suffolk middling thumb latch s o		1	1
" large		1	5
Brass middling		5	6
Ditto large		8	9
Night latch jap iron 2 bolt strong 4 in		3	10
Square plate latch iron 2 bolt 4 in		1	3
Pulpit or closet latch brass 1 bolt strong 3 in		4	1
Add for fixing Suffolk latches including screws		1	0
other		1	2

Locks

Description		6 in	7 in	8 in	9 in	10 in
		s d	s d	s d	s d	s d
Wood stock lock extra strong fine plate s o	each	1 6	1 8	2 0	2 5	2 10
Iron rim dead shot fine ward brass strong s o		2 9	3 10	6 0	8 3	10 6
Iron rim draw back solid ward with brass furniture s o		4 6	5 0	5 9	7 2	9 0
Iron rim fine ward strong cranked tail ditto, s o		2 10	3 6	5 6	—	—
Add if with Mace's strong furniture s o		0 7	0 8	0 9	—	—
Rim lock furniture strong brass Mace's spindle	per set	1 2	1 3	1 5	1 7	1 9
Mortise lock (warded) two bolt solid brass ward steel follower without furniture s o	each	5 2	6 9	—	—	—
Mortise lock (lever) two brass bolt two lever strong steel follower palace motion without furniture s o		6 4	8 0	—	—	—
Ditto but four lever ditto best make s o		11 0	13 0	—	—	—
Extra for half rebated		1 3	1 4	—	—	—
Extra for full rebated		6 0	6 6	—	—	—
Mortise lock furniture 2-in plain brass knob Mace's spindle extra strong s o	per set	2 9	3 0	—	—	—
Ditto Mace's white porcelain s o	per 2 bolt set	2 6	2 9	—	—	—
Add labour only for fixing stock locks	each	0 5	0 6	0 7	0 8	0 9
Ditto rim locks		0 10	0 11	1 0	1 1	1 2
Ditto mortise locks		1 6	1 9	—	—	—
Ditto furniture for locks		1 0	1 0	1 0	1 0	1 0

Locks for Fitments

Description		2 in	2½ in.	3 in	3½ in	4 in.
		s d	s d	s d	s d	s d
Iron cupboard locks three wheel tumbler strong	each	—	—	0 5½	0 6	0 7
Ditto, ditto, two lever, brass bolt strong	,,	—	—	2 1	2 2	2 3
Cut cupboard locks two lever strong (to differ)	,,	1 7	1 9	1 11	2 2	3 0
Till or drawer, ditto ditto	,,	1 7	1 9	2 0	2 3	3 0
Box or chest ditto ditto	,,	2 1	2 3	2 4	2 9	3 4
Brass cabinet ditto, ditto	,,	2 1	2 3	2 4	2 9	3 4
Japanned iron padlocks, full warded tumbler	,,	1 4	1 6	1 8	—	—
Galvanised ditto ditto	,,	1 8	2 0	2 4	—	—
Brass padlocks two lever, all brass two keys strong	,,	5 0	6 0	7 3	—	—
Add labour for fixing cup hoard drawer or chest locks	,,	0 3½	0 4	0 4½	0 5	0 5½

		s d
Hat and coat hooks, strong iron, 5 in single	each	0 2
,, ,, strong brass	,,	0 10
,, ,, mall iron, 7 in double	,,	0 5
,, ,, strong brass	,,	1 3
Add for fixing foregoing with screws	,,	0 2
Pivots and sockets for swing sashes, wrought iron	,,	0 4
,, ,, ,, ,, gun metal	,,	0 10
Add for fixing ditto	,,	0 4
Finger plates, plain oak, polished or dull	,,	1 2
,, white china 12 in × 3 in	,,	0 8
[illegible]	,,	0 3
[illegible]	,,	6 4
[illegible]	,,	1 6
[illegible]	,,	12 0
[illegible]	,,	0 6
,, ,, ,, ,, 2 in	,,	0 8
,, brass, with brass sheaves, 1¼ in	,,	1 2
,, ,, ,, ,, ,, 2 in	,,	3 0
[illegible]	,,	0 4
[illegible]	,,	
[illegible] and		1 0
[illegible]	,,	0 3
[illegible]	,,	0 11
[illegible] plate	,,	1 1
[illegible]	,,	0 6
[illegible] doors	,,	0 3
Brass ,, ,, ,, ,, ,, ,,	,,	0 7
Add for fixing ditto	,	0 4
Casement stays, mall iron, 12 in, to drop over pin	,,	0 10
,, ,, ,, 18 in ,, ,,	,,	1 1

		s	d
Casement, stays, brass 12 in, to drop over pin	each	2	9
" " " 18 in "	"	3	6
Mall iron flush shutter rings, 3 in	"	0	7
Brass " " " 2 in	"	0	10
" " " " 3 in	"	1	9
Iron rod door springs, strong 18 in	"	2	0
" " " 21 in	"	2	6
Jap iron patent helical door springs, 6 in	"	3	3
Brass " "	"	5	6
1 in tinned wire staples	per gross	0	3
1¼ in " "	"	0	5½
1½ in strong brass cup hooks	"	31	0
¾ in brass picture rod	per ft run	0	6
¾ in iron " painted	"	0	4
Shelf brackets iron, plain 12 in × 10 in	each	0	10
" " " 6 in × 5 in	"	0	4

ANALYSIS

In this trade every builder should consult the *Timber Trades Journal*, a regular perusal of which will be of unlimited value This paper gives the annual reports of the wood brokers (who act as agents for the shipper) reviews of large timber sales, lists of shipping ports, marks and brands of timber, how sold, &c It is only the timber merchant and big contractor who purchase at these public auctions, and the average builder usually buys from the former at the middleman s profit of from 5 to 10 per cent

The principal ports of entry are London Liverpool (for American wood), Hull Grimsby, Bristol, Cardiff, &c In London, the Surrey Commercial Docks are used almost exclusively for soft woods, the London and India Docks for hard woods, and the Millwall Docks for soft woods, as well

sometimes from dishonest reasons Some are bracker s or sorter s marks, and some are private ones Indeed, the question of brands, marks, and quality is in hopeless confusion, and it is useless for the ordinary builder to attempt to know more than what is sufficient to prevent himself from being defrauded One writer states " There is a great difference between the wood which different firms send out under the same denomination The first quality of one firm may be no better than the second quality of another, and so the architect will ultimately have to approve or condemn the material, not according to the marks on it, but according to

its actual goodness or badness Another point to be particularly noted is, that what the shipper calls second quality the timber merchant calls 'first quality', what the shipper calls 'third quality the timber merchant calls 'second quality, and so on

Dock Charges —Prices of timber, as well as of other goods

All deals and battens taken from the docks are subject to

ght of the

, housing

	s	d	
On goods for immediate removal and sawing	3	9	per Petersburg standard
If piled on wharf for stock and awaiting orders	5	0	

There is no landing rate on balk timber which is sold at per load

All timber under 9 in square is landed on the wharves 9 in square and over lies in the timber ponds

For timber loaded into barges the dock company charges 1s per load for cranage paid by purchaser

For timber loaded on to timber carriages or other vehicles the dock company charges 1s 6d per load for cranage paid by purchaser Timber purchased at dock sales is loaded by the company outside labour to load into trucks costs 2s or 2s 6d per Petersburg standard

Purchase from Timber Merchants —The sale and purchase of timber usully imply three transactions through —

(a) Shippers and exporters,
(b) Agents and brokers
(c) Importers and merchants

The preceding dock charges are useful to the contractor who attends the large auctions but he would more likely buy by the load from the timber merchant and saw mill proprietor Another way is to hand the latter a copy of the specification and quantities for the carpenter s work and contract for the sawn stuff at one uniform price say 2s per f c or even lower

Cartage —Deals are carted from the docks to the City at 10s per Petersburg standard or say $\frac{3}{4}d$ per foot cube The loading and unloading is paid by the importer, as a part of the dock charge

Balk timber is similarly conveyed for 4s per load of 50 cubic feet This is rather less than 1d per foot cube Only the

cartage from docks to saw mills need be reckoned, as the proprietors of the latter do not charge for delivery of stuff,

The weight of a St Petersburg standard of unplaned planks and boards (except pitch pine and hardwoods) is calculated and charged by railway companies at $2\frac{1}{2}$ tons per standard Pitch pine, deals, &c, under 4 in, are carried at 3 tons per standard Planed boards but not planks, any thickness (except pitch pine and hardwoods) are reckoned as weighing 2 tons 2 cwt per standard.

The following costs of carriage are an average of many different railway rates —

	d	*d*
Up to 20 miles averages	4 per mile per ton	or 10 per mile per standard
30	3	$7\frac{1}{2}$
40	$2\frac{3}{4}$	7
50	$2\frac{1}{2}$	6
75	$2\frac{1}{4}$	$5\frac{1}{2}$
100	$1\frac{3}{4}$	$4\frac{1}{2}$
150	$1\frac{1}{2}$	$3\frac{1}{2}$
200	$1\frac{1}{4}$	3
250	1	$2\frac{1}{2}$

To show the unfair preference given by railway companies to imported stuff it may be mentioned that foreign timber can be conveyed from our ports to midland towns, such as Birmingham, Leicester, or Nottingham at a trifle under 1*d* per mile per ton English timber the same distance 2*d* to 3*d* per mile per ton The rate of carriage for foreign timber from Cardiff to Birmingham is 8*s* 10*d*. per ton, while English timber is 16*s* 8*d*, or nearly double. To cut down timber in Wales and send it to the midlands of England costs considerably more for carriage than Norwegian timber can be sold for at the same place This helps to explain the cheapness of imported wood

Measurement —In London the sectional area of round timber is calculated by Custom House caliper measure, but in Glasgow, Dublin, and other home ports the solidity is taken by string measurement—by girthing the centre of the balk with string, and squaring $\frac{1}{4}$th length of the string in inches × length of balk in feet — 113 Allow $\frac{1}{2}$ to 1 in for the bark.

As hand sawing would be executed by a carpenter at 10½*d* per hour, its valuation per square can be worked out as below. The prices represent whole sawing for old stuff.

				s	*d*
A carpenter will saw—					
100 ft. super of	Baltic pine	in 5 hrs	× 10½*d* =	4	6
	American pine	in 4½	× 10½*d* =	3	11
	pitch pine	in 8	× 10½*d* =	7	0
	ash, beech, or elm	in 7	× 10½*d* =	6	2
	Honduras mahogany	in 7	× 10½*d* =	6	2
	Baltic or American oak	*in 7½*	× 10½*d* =	6	7
	English oak	in 9	× 10½*d* =	7	11
	Burmah teak	in 10	× 10½*d* =	8	9

¾ in. boards?

Allowing ⅛ in. for each saw kerf, we get 14 boards, each ¾ in. thick, and 13 whole cuts, as every board will have an equivalent to one half cut on either side—i.e., ¾ in. + 2 ($\frac{1}{16}$ in.) = ⅞ in. for each board and each whole cut together. The number of cuts is one less than the boards.

30 ft. run × 12 in. wide = 30 ft. super of 1 cut.
And 30 ft. super × 13 cuts = 390 ft. super of total sawing.
And 390 ft. super sawing at 7*s* per 100 ft. super = £1 7*s* 1*d*. answer.

Machine sawing.—Machine sawing is much superior to hand sawing—more precise, and can be done for about half the price. Circular saws, band saws, jig saws, and vertical saws are employed. Of these a properly constructed band saw will cut very nearly as fast as the best circular saws, while wasting fully 70 per cent. less wood in each cut, producing a much smoother surface, and taking only half the power to drive it. In machine work little allowance need be made for the saw cut, about $\frac{1}{16}$ in. For small shops, where there are less than twenty joiners, it is more economical and advantageous to employ a combined machine, such as a "General Joiner," which not only executes sawing but also performs the operations of planing, moulding, grooving, tenoning, mortising, and boring.

Example.—What will be the cost of sawing up by steam power two dozen 9 in. × 3 in. deals, each 12 ft. long, into ½ *in. boards at the rate of 80 ft. super of band sawing* per horse power per hour? Coals 15*d*., machinist 10½*d*., incidentals 2½*d*., = 2*s* 4*d* per hour.

To yield 4 in boards the 3 in thickness of deal would require 4 cuts producing 5 boards out of each piece of deal Each cut would be 12 ft long × 9 in wide

24/4/12 0
9
—— 864 ft super of sawing required

And $\frac{864}{80}$ = say 11 hours at 2*s* 4*d* = £1 5*s* 8*d* answer

Also if 80 ft super cost 2*s* 4*d* the cost of 100 ft super will be—

$$2s\ 4d \times \frac{100}{80} = 2s\ 11d \text{ per square}$$

Deeping and Flatting—Steam sawing costs about 3*s* per 100 ft sup for deal For machine sawn scantlings the standard is a deal 12 ft long × 9 in × 3 in

Sawing a deal by depth = 12 ft long × 9 in deep (called deeping) costs 1½*d* i.e. 1½*d* per 9 ft sup—practically a standard price

Sawing a deal by thickness = 12 ft long × 3 in thick (called flatting) costs 1*d* i.e. 1*d* per 3 ft sup—practically a standard price

Mill Charges for Sawing

		s	*d*
Baltic fir under 12 in square 3 cuts to the load	per load	7	6
12 in and over 4 cuts		7	6
sawing per 100 ft super	per square	4	0
Cross cuts	each	0	4
Cutting 4 in arris rail	per 100 ft run	2	0
5 in		2	3
Fir scantlings 6 in and under	per ft run	0	0¼
above 6 in		0	0½
Cartage per load of 50 ft cube	per mile	1	0

Sawing Battens Deals and Planks

Length	Battens	Deals	Planks
	Per doz cuts	Per doz cuts	Per doz cuts
ft	*s* *d*	*s* *d*	*s* *d*
6	1 4	1 6	2 0
7	1 6	1 9	2 3
8	1 8	2 0	2 6
9	1 10	2 3	2 9
10	2 0	2 6	3 0
11	2 2	2 9	3 3
12	2 3	3 0	3 6
13	2 4	3 3	3 10
14	2 6	3 6	4 3
15	2 8	3 9	4 9
16	2 10	4 0	5 0

SAWING BATTENS DEALS AND PLANKS—continued

Length	Battens.	Deals.	Planks.
	Per doz cuts	Per doz cuts	Per doz cuts
ft	s d	s d	s d
17	3 0	4 3	5 3
18	3 3	4 6	5 6
19	3 6	4 9	6 0
20	3 9	5 0	6 3
21	4 0	5 3	6 6
22	4 3	5 6	7 0
23	4 6	5 9	7 6
24	4 9	6 0	8 0
25	5 0	6 3	8 6
26	5 3	6 6	9 0
27	5 6	6 9	9 6
28	5 9	7 0	10 0
29	6 0	7 3	10 6
30	6 3	7 6	11 0

		s	d
Flatting 3 in and under	per 100 ft run	1	0
4 in		1	4
Deeping 12 to 15 in wide planks	per 100 ft sup	2	6
16 to 20 in		3	0

SAWING HARDWOODS

		s	d
Mahogany Honduras under 24 in deep and 1¼ in thick	per 100 f s	6	3
Mahogany Spanish		7	6
Teak		8	0
Yellow pine		5	0
Pitch pine		6	0
Wainscot		6	0
American ash and white wood		6	0
American oak elm and black walnut		7	0
English oak beech elm ash and chestnut		7	0
Planks 1¼ in thick and over extra		1	0
Cross cuts ash	each	0	6
mahogany		0	9

Cartage charged on 7 cuts and under at 7s 6d per ton of 40 f c

The foregoing prices for sawing include collection from docks and delivery after sawing within 3 miles of mills except the extra charges for cartage and landing rate

PLANING MATCHING &c TO DEAL

(MILL CHARGES)

	1¼ in and under	1½ in
Labours all at per 100 ft super —	s d	s d
Sawing and planing	2 3	2 6
and grooving	3 0	3 3
both sides	3 9	4 0

x 2

PLANING MATCHING &c TO DEAL—*continued*

	1¼ in and under		1½ in	
Labours all at per 100 ft super —	*s*	*d*	*s*	*d*
[illegible]	4	6	4	9
[illegible]	3	3	3	6
[illegible]	3	9	4	0
[illegible]	5	0	5	3
Planing boards when sawing charged separately	1	6	1	9
Grooving prepared boards at yard	1	6	1	9
Prepared boards grooved or beaded	1	9	2	0
matched only	2	0	2	3
matched and beaded	2	3	2	6
rebated and beaded only	2	6	2	9
Sawing edging and thicknessing	2	0	2	3
" " " and grooving	2	6	2	9

Stacking deal boarding 3*d* per square extra Oak 4*d* ditto

All the foregoing are nominal sawmill charges, and are liable to modification or 20 to 25 per cent discount For complete lists of rates apply to the various sawmills

The quantity of sawing required, as previously stated depends upon whether the scantlings are obtained from exact imported sizes, from deals, or from balk timber The amount of sawing also varies with the class of structure, for it decreases with the increase in the size of the timbers

Leaning shows, by a series of calculations from actual buildings that an average of some 360 ft super of whole sawing is required per load of 50 c ft if the scantlings are cut out of balk timber and that only 145 ft super are required per load if obtained from deal, or from imported sizes which need little conversion

TIMBER PER LOAD

Carpenters work such as girders joists plates &c, is executed partly from balk timber and partly from deal timber and the basis of calculation would be by the load of 50 c ft Joiners work, on the other hand, is generally converted out of deal, with the St Petersburg standard as the usual criterion

Carpenter s Timber—The fir timber is commonly specified to be from Memel, Riga or Dantzic, but Memel has ceased to send Riga is spongy and poor, while Dantzic is of small size and bad quality Baltic and White Sea timber, Pitch pine, and Oregon pine have largely replaced these on account of their resemblance, larger scantlings, and easier obtainment. Oregon pine is also known as Douglas pine, or

British Columbian pine. Modern specification suggested by the editor of the *Timber News* —

> Wood for carcassing or carpentry shall be sawn out of sound bright square-edged Baltic or White Sea planks deals and battens equal to best middling or Pitch pine or Oregon pine of similar quality
>
> Timber to be free from injurious open shakes large loose or dead knots or more than a small proportion of perfectly bright sap and thoroughly seasoned. All sides sawn die square with sharp angles

Price per Load —The average prices per load of 50 c ft of squared timber bought by the contractor at the large dock sales, are as follows —

PRICE PER LOAD

	£	s	d		£	s	d
Best Baltic fir timber	5	10	0	English oak	5	10	0
Best middling	5	0	0	Dantzic and Memel oak	6	0	0
Good middling	4	10	0	Riga wainscot oak	6	0	0
Pitch pine	5	10	0	Quebec oak	8	0	0
American red pine	5	0	0	Quebec yellow pine	7	0	0
American yellow pine	6	0	0	Teak Burmah	20	0	0
Small Swedish fir	3	0	0	Greenheart	9	0	0

There is no landing rate charge for balk timber

Price per Foot Cube —After purchase the balks are taken [illegible]

sawing and carting but this is a mere rule of thumb and seems insufficient. Bearing in mind previous statements, the particulars of the total cost would then appear —

ANALYSIS OF COST OF BALK TIMBER

	£	s	d
1 load of 50 ft cube best middling Baltic	5	0	0
Cartage from docks to sawmills	0	4	0
25 per cent waste on £5 for slabbing	1	5	0
7½ sawing die square	0	7	6
2½ cross cutting to lengths	0	2	6
360 ft sup of whole sawing for scantlings at 4s per 100 f s	0	14	5
Total per load	50)7	13	5
Net price per foot cube delivered on site	0	3	0

The profit is added on each detailed item further on

If, however the builder can get all his sizes for carpenter's work out of deal timber or imported scantlings the

labour of sawing would be largely saved, and the analysis would be as follows. Suitable deals would cost about £15 per St Petersburg standard of 165 ft cube, which is equivalent to £4 10s 11d per load of 50 ft cube, or some 10 per cent lower than balk timber. The waste will also be less. Carpenter's deals are cheaper than joiner's.

Analysis of Cost of Deal Timber

	£	s	d
1 load of deal at £4 10s 11d (or £15 per standard)	4	10	11
Cartage from docks to sawmills	0	4	0
2½ per cent waste on £4 10s 11d for cross cutting to lengths	0	2	3½
145 ft super of sawing for conversion at 4s per 100 ft super	0	5	9½
Total per load 50)	5	3	0
Net price per foot cube delivered on site	0	2	0

As a matter of fact the carpenter's work is derived from both balk and deal timber, and the proportion of each kind depends upon the style of building. It would, therefore, be a great convenience to evolve a rate which would embody both, and which would be applicable to most cases. This proportion would be approximately ⅓ balk and ⅔ deal, and such a price may be ascertained thus:—

Mixed Balk and Deal

	s	d
3s price of balk timber × ⅓	1	0
2s " deal × ⅔	1	4
Price per ft cube delivered on site	2	4

The relative cost per foot super 1 in thick is $\frac{1}{12}$ price per foot cube, *e.g.* 2s per f.c. × $\frac{1}{12}$ = 2d per f.s. 1 in thick.

Length affects Price.—Timber merchants will supply whole or half in timbers in various lengths up to 45 ft at a standard rate (say 2s per f.c.) if the *average* length does not exceed 27 ft. Should the average of any lot exceed 27 ft by any given number of feet that number will be the number of shillings per load of 50 c. ft extra charge which will be made. Say the average length is 34 ft, then the excess is 7 ft, and the price is 7s per load dearer than if the average had been 27 ft or under. Approximately the extra charge is ⅛d per foot cube on all the timber for each cubic foot the average is in excess of 27 ft.

Deals per Standard

The carpenter having supplied all the rough and heavy woodwork which is generally hidden, the joiner puts up the lighter framed stuff, fittings exposed to view—such as doors, windows &c —which are prepared, ready for fixing, at the workshops Consequently joinery should be made from the best material Nowadays the carpenter is only regarded as being capable of doing the rougher kinds of work—such as joisting roofing centres, &c —manipulated at site On the contrary, the joiner is a more skilled workman, but is threatened by machinery and machine made joinery to be transformed into a wood fitter The joiner s trade is often sub let

Joiner s Timber —Specifications stating deals to be best Petersburg Baltic red Archangel, or yellow Christiania, are incorrect Russian deals are from the Baltic (Petersburg, &c), and White Sea (Archangel Kem, Onega Soroka, &c), and are the best Finnish (Bjorneborg Wyburg, &c) a certain quantity Swedish (Gefle, Gothenburg, Soderhamn, Sundswall &c) first quality are excellent Norwegian

or red deal but very free from knots Proper description therefore —

> The wood for joinery to be Baltic or White Sea yellow deals, equal in quality to the best Russian or Swedish shipments, well seasoned and supplied in such lengths and breadths as may be ordered '

Sale —A hundred of deals = 120 deals of specified length and size, trade custom They are usually sold by the 'standard hundred," or, as it is generally called, the " standard ' The basis of calculation will then be the St Petersburg standard of 120 deals, 12 ft × 11 in × $1\frac{1}{2}$ in = 1,320 ft sup of $1\frac{1}{2}$ in thick, or 165 ft cub Other sizes are reduced to this criterion, but as deals are sold in various other ways, the matter is so confusing that tables for timber calculation are almost indispensable, or the estimator must work it out

Dock Prices —The best joiner's deals cost at the dock sales —

Price of Deals

	£ £
Yellow deals, Baltic (St Petersburg &c) 1st quality, per standard	16 to 23
Ditto White Sea (Archangel &c) 1st quality per standard	21 , 26

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Analysis of Cost of Deal Timber

	£	s	d
	4	10	11
	0	4	0
	0	2	3½
	0	5	2½
Total per l ad	50)5	3	0
Net price per foot cube delivered on site	0	2	0

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Mixed Balk and Deal

	s	d
3s price of balk timber × ⅓	1	0
2s deal × ⅔	1	4
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'The wood for joinery to be Baltic or White Sea yellow deals equal in quality to the best Russian or Swedish shipments well seasoned and supplied in such lengths and breadths as may be ordered'

Sale—A hundred of deals = 120 deals of specified length and size, trade custom They are usually sold by the "standard hundred," or, as it is generally called, the "standard" The basis of calculation will then be the St Petersburg standard of 120 deals, 12 ft × 11 in × $1\frac{1}{2}$ in = 1,320 ft sup of $1\frac{1}{2}$ in thick, or 165 ft cub Other sizes are reduced to this criterion, but as deals are sold in various other ways the matter is so confusing that tables for timber calculation are almost indispensable, or the estimator must work it out

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Ditto White Sea (Archangel, &c) 1st quality per standard	21	26

PRICE OF DEALS—*continued*	£	£
White deals Baltic (St Petersburg, &c), 1st quality, per standard	12 to	16
Ditto White Sea (Archangel, &c) 1st quality, per standard	12 ,	16
Pitch pine deals Pensacola, 1st quality, per standard	18 ,	23
Yellow pine deals Quebec " " "	34 ,	44

2nds 3rds or other qualities and battens, considerably less

and 10 per cent waste in sawing and conversion The cost of sawing would depend upon the thickness and lengths of boards required and may be kept separate if convenient

Deals ½ in thick —If ½ in boards are wanted, this would mean 2 cuts down the breadths of 120 planks, 12 ft × 11 in × 1½ in, or 120 × 2 = 240 cuts, 12 ft long × 11 in wide = 20 doz at 3*s* 6*d* per dozen

ANALYSIS OF COST OF DEALS

	£	*s*	*d*
1 standard of 1 320 f s best St Petersburg deals	20	0	0
	0	3	9
	0	1	6
	0	10	0
	3	10	0
	2	0	0
Total per standard 3 960)	26	5	3
Net price per foot super ½ in thick, delivered on site	0	0	1¼

In this case, as three thicknesses were cut out of the standard thickness of 1½ in, the divisor stood 1,320 × 3 = 3,960 By altering this divisor in a similar manner the prices per foot super for other widths and thicknesses can be easily calculated If there is a large quantity of sawing the saw mill owners will include the cost of cartage from the docks in their rates, and collect the timber themselves, as well as deliver it And if the builder keeps the wood two years or more for seasoning he will have to insert in the foregoing analysis the interest for that time on its outlay, or else reckon it among his establishment charges

Cost of Deals per Standard—The following example shows how to find the value of odd quantities of deals at a given price per standard

1 std 20 deals at £21 10*s* per standard

The deals will always be found to work out at 2*d* to each standard pound the rule being—reckon twice as many

pence as there are pounds in the price, to each part Thus in £21 10s 0d, the price of a standard, there are just 43 pence, which, when multiplied by the number of deals over, 20, will give their value, as, for example

```
£21 10  0 per standard
        2
      ----
       43 pence
       20 deals
      ----
    12)860 pence
      ----
   £3 11s 8d cost of 20 deals
```

	£	s	d
Cost of 1 standard	21	10	0
Cost of 20 deals	3	11	8
Total cost	25	1	8

Lineal Feet per Standard.—The Petersburg standard = 165 f c, and by remembering this equals 23,760 cub. in (165 f c × 1,728 cub in. ÷ 12 ft. lengths), the number of feet run of any scantling in a standard is readily obtained Thus, 11 in × $1\frac{1}{2}$ in —

```
  11)23760
   ------
 1½)2160
   ------
    1440 ft run, or 120 of 12 ft lengths
```

Or 23,760 ÷ 11 in × $1\frac{1}{2}$ in, i e $16\frac{1}{2}$ in Then—

23,760 ÷ $16\frac{1}{2}$ = 1,440 ft run, as before

Standards in Loads.—To ascertain the Standard quantity in so many loads, add one cipher to the latter, and divide by 3 and 11. Example, in 1,500 loads how many standards?

1,500 + 0 = 15 000 and—

```
   3)15,000
    ------
  11)5 000
    ------
    454 6/11 standards
```

A standard = 165 ft cub., and a load = 50 ft. cub. The Petersburg standard therefore = 165 ÷ 50 = 3 3 loads

Special tables for pricing save much timber calculations.

Planing

Specified sizes usually imply, unless otherwise stated, those sizes less the waste caused by the wrought faces. If

COMPARATIVE TABLE OF PRICES—*continued*

At per Cubic Foot.		Per Load of 50 cub. ft. (soft woods).			Per Ton of 40 cub. ft. (hard woods)			Per Fathom of 6 ft. × 6 ft × 6 ft., or 216 cub ft.			Per Petersburg Standard of 12 0 − 6 × 11" × 3" or 165 cub. ft.			Per London and Irish Standard of 120 − 12 × 9" × 3" or 270 cub. ft		
s	*d.*	£	*s*	*d*	£	*s*	*d*	£	*s*	*d*	£	*s*	*d*	£	*s*	*d*
1	1	2	14	2	2	3	4	11	14	0	8	18	9	14	12	6
1	2	2	18	4	2	6	8	12	12	0	9	12	6	15	15	0
1	3	3	2	6	2	10	0	13	10	0	10	6	3	16	17	6
1	4	3	6	8	2	13	4	14	8	0	11	0	0	18	0	0
1	5	3	10	10	2	16	8	15	6	0	11	13	9	19	2	6
1	6	3	15	0	3	0	0	16	4	0	12	7	6	20	5	0
1	7	3	19	2	3	3	4	17	2	0	13	1	3	21	7	6
1	8	4	3	4	3	6	8	18	0	0	13	15	0	22	10	0
1	9	4	7	6	3	10	0	18	18	0	14	8	9	23	12	6
1	10	4	11	8	3	13	4	19	16	0	15	2	6	24	15	0
1	11	4	15	10	3	16	8	20	14	0	15	16	3	25	17	6
2	0	5	0	0	4	0	0	21	12	0	16	10	0	27	0	0
2	1	5	4	2	4	3	4	22	10	0	17	3	9	28	2	6
2	2	5	8	4	4	6	8	23	8	0	17	17	6	29	5	0
2	3	5	12	6	4	10	0	24	6	0	18	11	3	30	7	6
2	4	5	16	8	4	13	4	25	4	0	19	5	0	31	10	0
2	5	6	0	10	4	16	8	26	2	0	19	18	9	32	12	6
2	6	6	5	0	5	0	0	27	0	0	20	12	6	33	15	0
2	7	6	9	2	5	3	4	27	18	0	21	6	3	34	17	6
2	8	6	13	4	5	6	8	28	16	0	22	0	0	36	0	0
2	9	6	17	6	5	10	0	29	14	0	22	13	9	37	2	6
2	10	7	1	8	5	13	4	30	12	0	23	7	6	38	5	0
2	11	7	5	10	5	16	8	31	10	0	24	1	3	39	7	6
3	0	7	10	0	7	0	0	32	8	0	24	15	0	40	10	0

VARIOUS LABOURS

The following are some constants of labour for ordinary work on fir, which have been extracted from the treatises of Leaning, Hurst, and Fletcher Labour on hardwoods may be generally taken at twice such values These constants represent the theoretical time, and the practical estimator seldom employs them

		Hours of a Carpenter
Labour fixing plates, lintels, &c (bedding taken in bricklayer)	per ft cube	40
Ditto, ground joists	„	50
Ditto, framed bridging joists and trimmers	„	66
Ditto quarter partitions, tenoned	„	1·00
Ditto, „ and trussed	„	1 23
Ditto, fixing fir in roofs	„	·90
Ditto in roof trusses, exclusive of hoisting	„	1 23
Ditto, in ceiling joists	„	1·00

			Hours of a Carpenter
Labour to fir wrought and framed		per ft cube	·00
Ditto, and rebated			2·60
Ditto	and beaded		3·00
Ditto	proper door casings		3·50
Chamfers 1 in wide and under	straight labour only	per ft run	·02
	cross-grain		·03
	circular		·05
Beads	straight		·03
	cross grain		·05
	circular		·0[illegible]
Staff bead	straight		·09
	cross-grain		·12
	circular		15

If chamfers and beads are stopped increase constant by one half.

Cutting 2 in. thick and under	raking labour only	per ft run	·06
	circular		·09
[illegible]			·03
			·09
			·08
	labour only		·03
	cross-grain		·09
	circular		·12
Rounded edges	straight		·0[illegible]
	circular		·09
Edges shot 1 in and under		per 100 ft run	[illegible]
over 1 in to 2 in			1·00
Mouldings, 2 in girth and under	straight labour only	per ft run	·12
	cross grain		·19
	circular		·24
over 2 in girth	straight labour only	per ft sup	[illegible]
	cross-grain		1·08
	circular		1·44
Ditto including double architraves			1·00

If foregoing are stopped increase the constant by one-half

Battening including plugging to wall ⅞ in to 1¼ in at 12 in centres		per square	[illegible]·00
Fixing only ⅞ in rough boarding to roofs edges shot straight			3·00
1 in. ditto			3·30
1¼ in ditto			3·80
slating battens for Countess slating			2·00
inodorous felt to roofs			2·00
sound boarding and fillet			8·00
centering to vaults			10·00
centering to concrete floors			6·00
gutter boards and bearers		per ft sup	·05
centering to trimmer arches			30
to openings			30
bracketing for cornices			·04
centering to 4½ in soffits		per ft run	11
9 in			·04
„ rough fillet			·03
„ eaves fillet			·06

		Hours of a Carpenter
Fixing only rolls for lead	per ft run	·09
herring bone strutting to 9 in joists		14
9 in to 12 in joists		17
grounds for skirtings &c		05
framed		08
fascias or skirtings 6 in and under		10
6 in to 9 in		13
Framed partitions 1½ in square framed	per ft sup	50
add if moulded o s		10
B S		20
Labour from bench 1 in shelves wrot B S no bearers		20
W C flaps and frames fixing and hanging		16
Shutters 1 in deal 2 panel square-framed		1·00
add for every extra panel		20
add if bead butt or moulded o s		18
		12
		35
		40
		·08
		15
		70
add for each extra panel		·07
add if bead butt or moulded		10

Other constants are given further on with various items of work

Miscellaneous

A carpenter takes 3 hrs to scarf a joint 18 in long in an 8 in × 5 in purlin

Ditto 1 hour ditto 7 in × 1½ in ridge plate

Ditto 1 hour to prepare 12 ft run of 4½ in × 3 in (about 1 f c) wall plate ready for bricklayer to bed

Nails and Screws

Nails —It will be convenient to consider here the cost of nails and screws before proceeding to the question of fixing woodwork Steel nails are the best and cut clasp are mostly used Their uniformity of size and make with freedom from waste renders them economical especially as their price is but slightly in excess of iron ones As a general rule the lengths are determined by taking rather more than twice the thickness of wood to be fixed For instance 1¼ in flooring would require 2¾ in or even 3 in nails This custom however applies more to boarding and would be modified in the case of scantlings of considerable size The following lists will indicate the lengths weights, and net prices at a glance It will be observed that the smaller the nail the higher the price per cwt When nails are nominally sold by the thousand it will be found in practice that if counted the thousand varies from 800 to 900 only Allow 10 per cent for waste in driving

NAILS STEEL

	Size	Per 1000	Per Cwt. s	Per Cwt. d		Per Lb d
Spike	5 in. weigh	190 lbs. and cost	18	6	or	2
	6	262	17	6		
	7	375	17	0		1¾
	8	525	16	6		1¾
	9	656	16	0		1¾
	10	900	15	9		1¾
Rosehead	1	3	24	0		2½
	1¼	4	21	0		2¼
	1½	5	18	0		2
	1¾	7	15	6		1¾
	2	10	14	0		1½
	2¼	13	14	0		1½
	2½	16	13	3		1½
	2¾	21	12	9		1½
	3	21	12	6		1¼
	3¼	28	12	3		1¼
	3½	33	12	0		1¼
	3¾	36	11	9		1¼
	4	40	11	6		1¼
Cut clasp	1	1¼	20	0		2¼
	1¼	3	15	0		1¾
	1½	3½	13	6		1½
	2	8	12	0		1¼
	2½	12	11	0		1¼
	3	20	10	6		1
	3½	25	10	6		1
	4	40	10	6		1
	4½	60	10	6		1
	5	67	10	6		1
Wrought brads	½	½	50	0		5¼
	¾	¾	35	0		3¾
	1	1	30	0		3¼
	1¼	2	27	0		3
	1½	3	25	0		2¾
	2	5	23	6		2½
	2¼	10½	19	0		2
	2½	15½	17	6		[illegible]
	3	18	16	0		1¾

Wire nails, flat square head (mixed) cost 11s. per cwt. or 1¼d. per lb.

Screws. — Nettlefold's patent screws are now almost wholly employed, and are frequently termed "fine", "middling", or "strong", but it is better to state the gauge as well as the length. This gauge, or diameter, is indicated by the number in describing the screw, and increases with that number. The following are the trade rules for the measurement of all screws:—

(1) All countersunk screws are measured overall.
(2) All raised head screws are measured to the top of countersink.

(3) All round cone square hexagon and cheese head screws are measured from the underside of head

A list with fixed prices is published by the screw merchants off which there is a discount of 60 per cent for iron, and 50 per cent for brass Nettlefold s list is the one almost universally adopted Screws are mostly used by the joiner and are often called "wood screws possibly to distinguish them from those of a different make in vogue for metal Allow 10 per cent for waste in using same as for nails Their lengths are likewise settled by taking about twice the thickness of wood to be fixed For hardwoods brass screws would be used, and of a somewhat lighter gauge than for deal

Screws are sold by the dozen, or by the gross of 12 dozen (144) wholesale

For driving screws allow 10 minutes or $\frac{1}{6}$ hour joiner at $10\frac{1}{2}d$ per inch per dozen $= 1\frac{3}{4}d$ Double this time for hardwood

Items of Work

Only the principal items have been analysed, others can be worked out from these as a guide, the labour being obtained from the tables of constants

Timber Fixed, but not Framed

Fir, rough in Plates, &c—As this would probably be cut partly out of balk and partly out of deal timber, but mostly the latter take 2*s* as the price per foot cube, supplied only But the estimator can start with 3*s*, 2*s*, or 2*s* 4*d*, according to his judgment Allow $\frac{2}{3}$ hour (40 constant) for labour in preparing and fixing, as the bedding is included in bricklayer s work

	s	*d*
[illegible]	2	0
[illegible]	0	1
[illegible]	0	$0\frac{1}{4}$
[illegible]	0	$4\frac{1}{4}$
	2	$5\frac{1}{2}$
Add 20 per cent profit &c	0	$5\frac{1}{2}$
Price per foot cube	2	11

Fir wrought ditto—To the foregoing it would merely be necessary to add the cost of planing, which would be four sides or 4 ft super, as the ends of these scantlings would not be taken into account As carpenter s work is invariably

hand planed the rate would be 1d per foot super Labour in preparing and fixing a trifle extra on account of timber being wrought, say ½ hour

	s	d
	2	0
	0	1
	0	0¼
	0	4
	0	5¼
	2	10½
Add 20 per cent profit &c	0	6½
Price per foot cube	3	5

Timber Framed and Fixed

Fir, rough in Roof Trusses &c —This would be analysed as previous examples No nails are necessary The labour here is 1 hour carpenter

	s	d
1 ft cube of rough fir delivered on site	2	0
Waste in cutting and fixing 5 per cent	0	1
Framing and fixing 1 hour carpenter at 10½d	0	10½
	2	11½
Add 20 per cent profit &c	0	7½
Price per foot cube	3	7

A carpenter will fix 20 purlin cleats 12 in × 5 in × 4 in per hour on roof

Fir wrought ditto —In roofs and trusses there will be the full proportion of planing assumed that is six sides or 6 ft super per cubic foot of fir owing to the large quantity of smooth face compared with the cubic contents of timber Labour in framing and fixing also a little more on account of woodwork being wrought about 1¼ hour

	s	d
	2	0
	0	1
	0	6
	1	2
	3	9
Add 20 per cent profit &c	0	9
Price per foot cube	4	6

Hoisting Trusses —For hoisting trusses a handy calculation is to multiply the two dimensions together and divide by 10

the quotient to be taken as pence Thus to raise a truss 20 ft span, 30 ft high—

$$20 \times 30 = 600 \div 10 = 60d, \text{ or } 5s$$

Proper Fir Door Frames, wrought, framed, chamfered or beaded, and fixed—These would be similarly worked out The following constants of labour will be useful —

		Hours of a Carpenter
Wrought rebated and beaded or chamfered door frames labour making and fixing	per ft cube	3·00
Double rebated transoms ditto ditto	"	4·00
Fir wrought and framed	"	2·00
" and rebated	"	2·00

	s	d
1 ft cube of fir rough delivered on site	2	0
Waste in cutting and fixing 5 per cent	0	1
Labour complete 3 hours carpenter at 10½*d*	2	7½
	4	8½
Add 20 per cent profit &c	0	11½
Price per foot cube	5	8

It takes a carpenter about ½ day, or 4½ hrs, to make a 5 in × 4 in ordinary door frame, hand made, but only 2½ to 3 hours if machine worked

Segmental heads to door frames are worth twice straight

Semi circular and Gothic heads to door frames are worth 2½ times straight

Transoms, being in shorter lengths, with more work, require ½ more labour than frames

Door Frames per Foot Run—Door frames are sometimes more conveniently rated at per foot run, and made in certain stock sizes for various widths of openings Prices annexed are for fir, wrought, framed rebated, chamfered or beaded, solid door frames, straight, fixed complete, including profit, establishment charges, &c

Door Frame

siz ns, or
5s

	ft		ft		in		in			s	d	
Openings	2	to	3	wide have	4½	×	3	frames at		0	6	per ft
"	3	"	5	" "	5	×	4	"	"	0	9	"
"	5	"	7	" "	6	×	5	"	"	1	0	"
"	7	"	9	" "	7½	×	4	"	"	1	3	"
"	9	"	12	" "	9	×	5	"	"	1	6	"
If extra rebate add										0	1	"
If extra chamfer or bead add										0	0½	"
If moulded under 3 in girt add										0	1½	"

If pitch pine add ½ deal and mahogany 3 times deal

Architraves

5 in × 1¼ in Deal moulded Architrave and Fixed — These are machine made and a good pattern would cost 20s per 100 ft run The analysis would be for this length and the total divided by 100 to reduce it to the unit of 1 ft run

	s	d
100 ft run of 5 in × 1¼ in architrave	20	0
10 per cent waste on ditto	2	0
Cartage to site and unloading	1	0
Nails 3 in wrought brads 3 lbs at 1¾d	0	5
Cleaning up and fixing 12 hrs joiner at 10½d	10	6
	33	11
Add 20 per cent profit &c	6	9
	100)40	8
Price per foot run	0	5

Battens and Fillets

Price —The above may be conveniently taken together As stated under Tiler battens or laths are imported ready sawn in various sizes and may be bought usually in 10 ft lengths at the sawmills at the following prices —

Measurement	1 in × ¾ in	1½ in × 1 in	1¼ in × ¾ in	1 in × ½ in
	s d	s d	s d	s d
Battens per 100 ft run	1 0	0 9	0 8	0 7
1 ft	0 0⅛	0 0⅛	0 0⅛	0 0$\frac{1}{12}$

The prices of fillets are found from deals according to the cost per standard As there are 165 ft cube and 1 980 ft super at 1 in thick in a St Petersburg standard the prices of the various sizes of fillets can thus be arrived at including sawing and 10 per cent for waste and breakage

Inch by Inch Method —Greenwood s ' Timber Calculator explains among other useful things the inch by inch' method of measuring timber which is based upon the prin be value of the timber is will be the same value in × 1 in For example £11 per standard is 11*d* per 100 ft run of 1 in × 1 in and £8 10*s* per standard is 8½*d* per 100 ft run of 1 in × 1 in

Further example —Supposing it is required to find out the

price of $3\frac{1}{2}$ in × 2 in filleting when deals are £10 10s per standard This is equivalent to $10\frac{1}{2}d$ per 100 ft run of 1 in × 1 in fillets by foregoing rule And $3\frac{1}{2}$ in × 2 in = 7 sq in so that 7 sq in × $10\frac{1}{2}d$ = $73\frac{1}{2}d$ or 6s $1\frac{1}{2}d$ per 100 ft run of $3\frac{1}{2}$ in × 2 in fillet It will thus be seen

membering
f c is equal

per foot run to $\frac{1}{4}d$ per square inch of sectional area Thus take the following scantlings —

3 in × 2 in = 6 sq in at $\frac{1}{4}d$ = $1\frac{1}{2}d$ per foot run
4 in × 3 in = 12 sq in = 3d
5 in × 4 in = 20 sq in = 5d

table is required with every difference in rate per standard except when multiples can be employed Such useful tables are called the equation of deals The deals are at say £12 7s 6d per St Petersburg standard = 1s 6d per foot cube (£12 7s 6d ÷ 165) = $1\frac{1}{2}d$ per foot super at 1 in thick (£12 7s 6d ÷ 1 980) The table shows cost per foot run supplied only

SCANTLINGS AT £12 7s 6d PER STANDARD

Inches in width	[illegible]										
	4	[illegible]		[illegible]		[illegible]	$1\frac{1}{2}$	$1\frac{1}{4}$	1	$\frac{3}{4}$	$\frac{1}{2}$
	d	d	d	d	d	d	d	d	d	d	d
12	6	$5\frac{1}{4}$	$4\frac{1}{2}$	$3\frac{3}{4}$	3	[illegible]	[illegible]	$1\frac{3}{4}$	$1\frac{1}{2}$	$1\frac{1}{4}$	[illegible]
11	$5\frac{1}{2}$	$4\frac{3}{4}$	$4\frac{1}{4}$	$3\frac{1}{4}$	[illegible]	[illegible]		[illegible]	[illegible]	1	[illegible]
10	5	$4\frac{1}{4}$	[illegible]	[illegible]	$2\frac{1}{2}$	[illegible]	[illegible]	$1\frac{1}{2}$	[illegible]	[illegible]	[illegible]
9	$4\frac{1}{2}$	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
8	4	$3\frac{1}{2}$	3	[illegible]	2	[illegible]	[illegible]	[illegible]	1	[illegible]	[illegible]
7	$3\frac{1}{2}$	3	2		1	[illegible]	[illegible]	[illegible]			[illegible]
6	[illegible]	[illegible]	[illegible]	1	$1\frac{1}{2}$	[illegible]	[illegible]		[illegible]	[illegible]	[illegible]
5	[illegible]	[illegible]	[illegible]	$1\frac{1}{2}$	[illegible]	1	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
4		[illegible]	[illegible]	[illegible]	1		[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
3	$1\frac{1}{2}$	[illegible]	1		[illegible]		[illegible]		[illegible]	[illegible]	[illegible]
2	1	[illegible]	[illegible]		[illegible]		[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
1	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]

Labour —The constants of labour for foregoing will be —

		Hours of a Carpenter
Battening including plugging to wall ¾ in to 1¼ in at 12 in centres	per square	2·60
Fixing only battens to Countess slating		2·00
eaves fillet	per ft run	·06
rough fillet	„	·03

Analysis As an example of analysis take such an item as *3 in × 1½ in rough fillet and fixed* —

	s	d
1 ft run of 3 in × 1½ in rough fillet as per table	0	0½
Waste and 4 nail per ft run	0	0¼
Labour ·03 hour carpenter at 10½d	0	0¼
	0	1
Add 20 per cent profit &c	0	0¼
Price per foot run	0	1¼

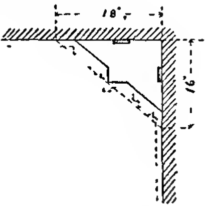
Battening for Slates

Deal Battening 2 in × ⅝ in, Spaced for Countess Slating and Fixed with Iron Nails —As already shown, battens of this size cost 1s 6d per 100 ft run, and would be spaced apart centre to centre at the same gauge as the slates—that is at 8½ in adopting the usual gauge for Countess slating laid to 3 in lap and nailed in centre A square being 10 ft or 120 in, each way, there would be 120 in ÷ 8½ in = 14 rows of battens, each 10 ft long = 140 ft of battening per square Reckon one nail 1¼ in long per foot run of batten as the rafters being spaced at 12 in would take the point of the nail whether there was roof boarding or not Allow 10 per cent waste in battens and nails and put down 2 hours carpenter for nailing The detailed sum would then appear —

	s	d
140 ft run of 2 in × ⅝ in battens at 1s 6d per 100 ft run	2	1¼
10 per cent waste on ditto	0	2½
Cartage unloading and hoisting to roof	1	6
140 nails + 10 per cent waste = 154 nails 1¼ in = ½ lb at 1½d	0	0¾
2 hours carpenter fixing at 10½d	1	9
	5	7½
Add 20 per cent profit &c	1	1½
Price per square	6	9

Bracketing

Below is a sketch of ordinary bracketing, which is supported by the two fillets shown, but these are taken separately A bracket of the shape given would measure 18 in × 16 in, extreme dimensions, and two brackets would be cut out of a rectangular board with these sides



Bracketing

The bracketing is measured by taking the length of the cornice by the girth of the moulding making a superficial dimension but there would be one bracket to each foot run Sawing must be allowed for the irregular shape and for the notches to receive the fillets Add nails and labour

			s	d
$\frac{1}{2}$/1 6 1 4				
——	1 0 ft sup 1 in rough deal small quantities		0	3
	Sawing to shape		0	0¼
	Cartag and waste		0	0¾
	Nails steel say		0	0¼
	Fixing ¼ hour carpenter at 10½*d*		0	2½
	Use of scaffolding		0	0¼
			0	6¾
	Add 20 per cent profit &c		0	1¼
	Price per foot super		0	8

Angle brackets would require about the same material but there would be twice as much labour as there is a bevel on each edge to receive the laths at either side. So the total comes to 11*d*.

Machine ... Boardings

1 *in Rough Deal Roof Boarding in Batten Widths and Fixed Complete.*—Rough deal boarding ¾ in., 1 in., and 1¼ in. thick is imported ready sawn from the Baltic, and if over this thickness has to be cut out of deals or battens. The prices at the docks are:—

		s	d
¾ in. rough boarding batten widths	per square	11	0
1 in.		13	0
1¼ in.		15	0

... ...0*s* for cartage
per ... ft super of
1 ... 10 per cent
waste. As the battens are 7 in. wide this would give 17 boards each 10 ft long per square, and, as there are two nails where each board crosses each rafter 12 in. apart, 340 nails plus 10 per cent waste equals 374, or 3 lbs. total of 2 in. nails required to the square. Labour laying 3¼ hours of carpenter.

	s	d
1 in. rough boarding cost per square at docks	13	0
Waste 10 per cent	1	4
...rd at 3*s* 9*d*	0	2¼
	0	6
	0	1¾
	0	1¾
	0	3¼
Labour laying 3¼ hours carpenter at 10½*d*	2	11
	18	6¼
Add 20 per cent. profit, &c.	3	8½
Total price per square	22	3

1 *in. Rough Deal Boarding traversed for Lead or Zinc and Firring to Falls.*—This roof would be detailed in a similar manner to the foregoing with the additional labour for traversing and the cost and fixing of the firrings. The latter would be an average size of 2 in. × 1½ in., taking a fall of 1½ in. in 10 ft, and the price of ⅜*d* per foot run from the table of Fillets given on p. 281.

Allow with waste 100 ft run per square and 3 lbs. of

2½ in nails For labour in cutting fitting and fixing the firrings take 2 hours carpenter The whole cost per square would thus appear —

	s	d
1 in rough boarding cost per square at docks	13	0
Waste 10 per cent	1	4
Landing rate $\frac{1}{20}$ standard at 3s 9d	0	2¼
Cartage ditto at 10s	0	6
Unloading ½ hour labourer at 7d	0	1¾
Hoisting to roof ditto	0	1½
2 in nails 3 lbs at 1¼d per lb	0	4
	2	11
	0	10½
	2	1½
	0	2½
	1	9
	21	7
Add 20 per cent profit &c	4	11
Total price per square	29	6

Machine prepared Matchboardings —For these it is only necessary to add to the foregoing calculations extra labour for more careful nailing and the cost of the sawmill charges as given on p 308 For example for 1 in V jointed match boarding prepared one side and fixed —

	s	d
1 in. rough deal boarding fixed as before	18	6½
Sawmill charge for preparing as p 308	3	7
Extra labour 2 hours carpenter at 10½d	1	9
	24	0½
Add 20 per cent profit &c	4	9½
Total price per square	28	10

Yellow deal matching however is imported all ready prepared in batten widths and if this is used its cost is totalled up just like rough boarding The prices at the docks are —

	Firsts s d	Seconds s d	Thirds s d
⅝ in × 7 in yellow deal matching per square	13 0	11 0	9 0
¾ in × 7 in	15 0	13 0	11 0
1 in × 7 in	18 0	16 0	11 0

If 6 in wide only 6d to 1s per square less

Deal Boarding

1 in *Rough Deal Boarding and Fixed* This too is calculated from the cost of boarding per square as already analysed and reduced to the foot super As it is intended

to be used in small quantities, more nails and labour will be required, and there will be also an addition for further sawing and waste

		s	d
1 in rough boarding fixed as before	per square 100)18		6¼
		0	2¼
Extra nails and labour		0	0¼
Further sawing and waste		0	0¼
		0	3¼
Add 20 per cent profit &c		0	0¾
Price per foot super		0	4

Other thicknesses and boardings can be similarly treated

1 in *Gutter Boards and Bearers* —Allow about ⅙th extra for waste in cutting and raking as the gutters taper on plan owing to the rise increasing 1 in width per 1 in rise The boards and bearers are of the roughest description, and the latter are taken as fixed, not framed

	s	d
[illegible]	0	1½
[illegible]	0	0¼
[illegible]	0	1¼
[illegible]	0	0¼
Labour ¼ hour carpenter at 10½ d	0	2½
	0	6
Add 20 per cent profit &c	0	1
Price per foot super	0	7

Centerings and Casings.

Use of 1 in Flat Centering to Concrete Floors, including Supports —Most of the material used for this is old stuff and can be utilised again Rough sills and heads, with supporting struts are essential at about every 5 ft apart and for all these 9 in × 3 in planks can be employed If the story is 14 ft high then allow about 130 ft run of this planking A labourer will be required to assist the carpenter in fixing and removing

	s	d
[illegible]	13	0
[illegible]	30	6½
[illegible]	0	9
[illegible]	2	0
[illegible]	0	3½
Initial cost of material per square	52	7

Then proceed to use and waste, fixing and removing —

	s	d
	5	3
	0	0¼
	5	3
	3	6
	14	0½
Add 20 per cent profit, &c	2	9½
Price per square	16	10

Turning Pieces for 4½ in Soffit and Fixing.—These are single slips of deal cambered on top edge, and without lagging pieces

	s	d
1 ft run of rough deal fillet	0	1½
Labour $\frac{1}{10}$ hour carpenter at 10½d	0	1
	0	2½
Add 20 per cent profit &c	0	0½
Price per foot run	0	3

Doors

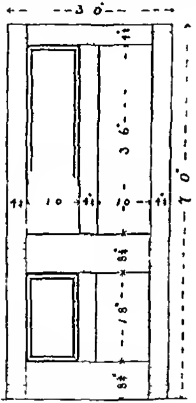
Before proceeding to analyse the cost of doors it will be well to know the following labours —

		Hours of a Joiner		
Making doors deal		1¼ in	1½ in	2 in
Ledged rough and edges shot	per ft sup	22	25	—
Ditto add if ploughed and tongued		47	51	—
ditto wrought n s		32	42	—
braced		05	06	—
if hung in one leaf		14	16	—
Square framed 2 panels		44	45	53
4		50	52	60
6		57	60	67
add to each face if moulded		11	11	11
if hung folding		15	15	15
Hanging doors		08	08	10
Ditto folding		16	16	20
Door linings				
Square planed fixed complete including		¾ in	1 in	1¼ in
backings		18	20	23
Single rebated ditto		—	29	30
Double rebated		—	36	38

A common price for hanging a door is 1s 6d in speculative building. Piecework at 1s each. A joiner will hang about 6 ordinary four panel doors per day, or 1 door in 1¼ hours which runs to about ¾d per foot sup. In preparing and erecting doors and gates, the time of a labourer should

be added for every two carpenters Hanging doors involves the fixing of the hinges but not the value of the latter, which comes under ironmongery

A joiner will make an 1½ in framed four panel door in over a day or say 11 hours, a 2 in framed ledged door in 17 hours and 2 ledged trap doors in a day In machine shops



Framed Panel Door

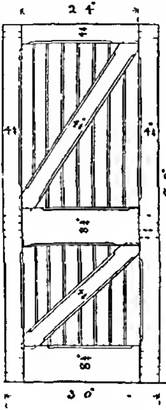
half this time as the stuff is given complete ready for fixing

D ent more
th more
th than
ordinary, doors prepared for glass 1d per f s more than ordinary

For finished sizes add 1d per foot super to the value of

framings. Partitions of spandrel shape are worth about 20 per cent more than rectangular ones.

To arrive at a price per foot super the cost of a whole door must be worked out in detail, and the result divided by the area in square feet will yield the rate per foot super.



Framed and Braced Door

1½ in *Deal Door, four panel Square framed and Moulded both Sides, and Hung.*—The drawing will clearly indicate the dimensions and construction. As the framing is supposed to be cut out of deals and half deals, an allowance of ¼ in each side has in this case been made for finished sizes, so that 9 in and 4½ in are taken up in the quantities. Panels are ¾ in thick and ½ in extra must be allowed in length and

breadth for insertion in the grooves along the inside of the framing In measuring the latter the tenons and horns must not be forgotten The moulding is planted on and would be machine made The door being 7 ft × 3 ft., contains 21 ft super, and its price per foot super would be arrived at in the following fashion —

	ft.	in.
Top rail	3	0
Stile	7	0
	7	0
Munting	3	6
	1	8
Tenons 4 2 in	0	8
	21	10

					s	d
22	10					
0	4½	8	7	Top rail stiles and munting		
23	0					
0	9	4	6	Middle and bottom rails		
		13	1	ft super of 1½ in wrot. b s deal s o, at 5d	5	5½
23	7					
1	1	7	9	Top panels		
21	9					
1	1	3	10	Bottom ditto		
		11	7	ft super of ⅝ in wrot b s deal s o at 3d	2	11
243	6	25	0			
241	8	13	4			
2[illegible]1	0	16	0			
		57	4	ft run of moulding b s, at ¾d	3	7
Mitres and fixing moulding say 58 ft run at ¼d					1	2½
Glue ½ lb at 9d and wedges ½d					0	5
Glass paper 4 sheets at ½d each					0	2
Labour making door 11 hours joiner at 10½d					9	7½
Labour hanging door 1½ hours joiner at 10½d					1	4
					24	8½
Add 20 per cent profit &c					4	11½
Price per door (21 ft s.)					21)29	8
Price per ft super					1	5

The labour in making the door thus works out to 5½d per foot super and ¾d per foot super for the hanging

A similar machine made door would only cost 12s., or 7d per foot super less than half

All other framed doors are dealt with in a similar manner, the cost of the hinges and locks being taken in the *Iron*
mc

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convenience of analysis, the same sizes have been adhered to as shown in the panel door, and the same allowances made for finished work The braces and middle and bottom rails are less the thickness of the 2 in framing by the thickness of the ½ in matchboarding, so that they measure only 1½ in thick See p 331

				ft	in
Top rail				3	0
Stile				7	0
”				7	0
				17	0

				s	d
17 0 0 4½	6 4	ft super 2 in wrot B s deal s o at 6d		3	2
7 8 0 4½	2 10	Braces			
23 0 0 0	4 6	Middle and bottom rails			
	7 4	ft super 1½ in wrot B s deal s o at 5d		3	0½
6 8 2 4	15 7	ft super ½ in matchboarding at 2d		2	7
28 ft run chamfering to framing at ¼d				0	7
24 stops to ditto at ½d				1	0
Glue town made ½ lb at 9d and wedges ½d				0	5
Glass paper 4 sheets at ½d each				0	2
Nails 1½ lbs at 1¼d per lb				0	2
Labour making door 17 hrs joiner at 10½d				14	10½
Labour hanging door 1¾ hrs joiner at 10½d				1	6½
				27	6½
Add 20 per cent profit &c				5	6
Price per door (21 ft s)				21)33	0½
Price per foot super				1	7

The labour in making is therefore 8½d per foot super, and 1d per foot super for the hanging

Doors door casings door frames &c, are supplied by joinery manufacturers ready made complete at extremely low rates and considerably under the preceding

breadth for insertion in the grooves along the inside of the framing. In measuring the latter, the tenons and horns must not be forgotten. The moulding is planted on and would be machine made. The door being 7 ft × 3 ft, contains 21 ft super, and its price per foot super would be arrived at in the following fashion:—

	ft	in
Top rail	3	0
Stile	7	0
	7	0
Munting	3	6
	1	8
Tenons 4 2 in	0	8
	22	10

					s	d
22	10					
0	4½	8	7	Top rail stiles and munting		
23	0					
0	9	1	6	Middle and bottom rails		
		13	1	ft super of 1½ in wrot b s deal s o, at 5d	5	5½
27	7					
1	1	7	9	Top panels		
21	9					
1	1	3	10	Bottom ditto		
		11	7	ft super of ¾ in wrot b s deal s o at 3d	2	11
243	6	28	0			
241	8	13	4			
281	0	16	0			
		57	4	ft run of moulding b s, at ¾d	3	7
Mitres and fixing moulding say 58 ft run at ¼d					1	2½
Glue ½ lb at 9d and wedges ½d					0	5
Glass paper 4 sheets at ½d each					0	2
Labour making door 11 hours joiner at 10½d					9	7½
Labour hanging door 1½ hours joiner at 10½d					1	4
					24	8½
Add 20 per cent profit &c					4	11½
Price per door (21 F S)					21)29	8
Price per ft super					1	5

The labour in making the door thus works out to 5½d per foot super and ¾d per foot super for the hanging.

A similar machine made door would only cost 12s or 7d per foot super less than half.

All other framed doors are dealt with in a similar manner, the cost of the hinges and locks being taken in the *Iron mon*

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convenience of analysis the same sizes have been adhered to as shown in the panel door, and the same allowances made for finished work The braces and middle and bottom rails are less the thickness of the 2 in framing by the thickness of the ¾ in matchboarding, so that they measure only 1¼ in thick See p 331

		ft in
	Top rail	3 0
	Stile	7 0
	"	7 0
		17 0
17 0 / 0 4½		
6 4	ft super 2 in wrot p s deal s o at 6d	s d / 3 2
7 8 / 0 4½	2 10 Braces	
23 0 / 0 3	4 6 Middle and bottom rails	
7 4	ft super 1¼ in wrot p s deal s o at 5d	3 0½
6 8 / 2 4		
15 "	ft super ¾ in matchboarding at 2d	2 "
	28 ft run chamfering to framing at ¼d	0 7
	24 stops to ditto at ½d	1 0
	Glue [illegible] made ¼ lb at 9d and wedges ½d	0 5
	Glass paper 4 sheets at ½d each	0 2
	Nails 1½ lbs at 1½d per lb	0 2
	Labour making door 17 hrs joiner at 10½d	14 10½
	Labour hanging door 1¾ hrs joiner at 10½d	1 6½
		27 6½
	Add 20 per cent profit &c	5 6
	Price per door (21 ft s)	21)33 0½
	Price per foot super	1 7

The labour in making is therefore 8½d per foot super, and 1d per foot super for the hanging

Doors, door casings, door frames &c, are supplied by joinery manufacturers ready made complete, at extremely low rates and considerably under the preceding

Floors

Deals and Battens per Square—One square of flooring requires—

		No	ft in
For floors rough		11 boards	12 × 9 (deal)
	edges shot	12½	
wrought and laid folding		13	
	straight joint	13½	
	ploughed and tongued	14	
rough		16	12 × 7 (batten)
	edges shot	16½	
wrought and laid folding		17	
	straight joint	18	
	ploughed and tongued	18	

Allow ½ in loss in breadth through grooving tonguing and waste

Customary Square—Prepared flooring boards are sold by the customary square, which is a given number of feet run as stated below varying with the width of the board but always so arranged as to approximate to the ordinary square of 100 f s

		Feet s per
160	8	= 106⅔
170	7½	= 106¼
180	7	(battens) = 105
185	6¾	= 104 1/16
190	6½	= 102 11/12
195	6¼	= 101 9/16
200	6	= 100
210	5¾	= 100⅝
220	5½	= 100 10/12
230	5¼	= 100⅝
240	5	= 100
270	4½	= 101¼
300	4	= 100

The foregoing number of feet run can be readily ascertained by dividing 1 200 by the width of the board in inches the 1 200 representing the number of lineal feet 1 in wide in a square Thus for 5 in boards—

1 200 ÷ 5 = 240 ft run of 5 in boards in a square

Waste = 10 per cent per square A load = 12 squares

NAILS FOR FLOORING

Thickness of Floor	Length of Nail	Weight per Thousand		Number per Square		
		Wrot. Brads	Cut Clasp	Deal Widths	Batten Widths	4½ Widths
in	in	lbs	lbs			
¾	2	7	8	260 or 290 allowing 10 per cent for waste	310 or 370, allowing 10 per cent for waste	520 or 570 allowing 10 per cent for waste
1	2½	11	12			
1¼	2¾	14	15			
1½	3¼	23	25			
1¾	3½	28	30			
2	4	38	40			
2¼	4½	48	50			
2½	5	60	65			

The nails used for deal widths should be about one fifth heavier than those for floors laid in batten widths. The number is calculated for two nails where each board crosses every joist, spaced at 12 in. centre to centre.

FLOORING LABOURS

		Hours for Carpenter
Floors laid and cramped only, batten widths, *straight joint, with splayed headings, 1 in.*	per square	3 50
Ditto 1¼ in.		4 00
1½ in.		4 50
2 in.		5 00
But tongued and grooved or rebated 1 in.		4 50
1¼ in.		5 00
1½ in.		5 50
2 in.		6 00
Add to foregoing if punched and puttied		2 00
for cleaning off afterwards		1 50

Yellow deal for flooring must not be confused with yellow pine. The former is the wood of the Scotch fir (*Pinus sylvestris*) and is otherwise called "red deal" or "red fir." That used in England comes almost entirely from the Baltic and White Sea. Yellow pine, otherwise called Weymouth [illegible] and stuff.

Prices

Flooring, tongued and grooved, i.e. ploughed and matched —

		Firsts		Seconds		Thirds	
		s	d	s	d	s	d
1 in. × 7 in.	per square	18	0	16	0	14	0
1¼ in. × 7 in.		20	0	18	0	16	0

If 6 in. wide or square edge, i.e. planed and shot, 1s. per square less.

... f s) of 1 in flooring (1,980 ft sup) so computed at £18

which is only 1 per cent more than the true value

Proceeding now to the analysis of an example of flooring 1¼ in *Yellow Deal Wrought Batten Floor, Ploughed and Tongued Splayed Headings Punched and Puttied*

	s	d
1¼ in yellow deal flooring seconds cost per square at docks	18	0
Waste in conversion 10 per cent	1	11
Landing rate $\frac{198}{1980}$ or say $\frac{1}{10}$th standard at 3s 9d	0	3
Cartage 10	0	7¼
[illegible]	0	1¾
	0	6¾
	4	4½
	1	9
	1	3½
	29	11
Add 20 per cent profit &c	5	7
Total price per square	31	6

deduct the latter The prices of the boarding and fillets have already been individually given but for these almost any old material is used As there would be a fillet nailed to either side of each joist 200 ft run of filleting would be needed per square

	s	d
¾ in rough boarding per square at docks	11	0
Landing rate $\frac{100}{1980}$ or $\frac{1}{20}$ standard at 3s 9d	0	1¾
Cartage 10	0	4¾
Unloading ½ hour labourer at d	0	1¾
200 ft run of 1¼ in × 1 in fillet at ⅛d	2	1
2 lbs nails steel at 1¼d per lb	0	2½
Fixing boarding and fillets 8 hrs carpenter at 10½d	7	0
	20	11¾
Add 20 per cent profit &c	4	2¼
Total price per square	25	2

2 *in* × 1½ *in Herring bone Strutting to* 11 *in Joists, and firmly Nailed* —Joists of this depth and 12 in apart would have two fillets each 1 ft 2 in measured sloping or a total of 2 ft 4 in per foot run taken horizontally across the top of the joists The custom of measuring the joists in only partially counterbalances the waste in cross cutting the fillets

	s	d
2 ft 4 in of 2 in × 1½ in rough fillet at ½d	0	1
Cartage and extra waste in cutting	0	0½
Nails steel say ¼ lb at 1½d per lb	0	0¼
Labour cutting 4 splayed ends to fit joists at ¼d	0	1
Labour fixing ⅛ hour carpenter at 10½d	0	1¼
	0	4
Add 20 per cent profit &c	0	0¾
Price per foot run	0	4¾

Rolls

2 *in Deal Roll for Lead and Fixed* —Deal rolls are generally rounded by machinery and are bought ready for fixing at the sawmills The detailed calculation is simple

	s	d
1 ft run of 2 in roll at sawmills	0	1¼
Waste cutting to lengths and nails	0	0½
Labour nailing	0	0½
	0	2¼
Add 20 per cent profit, &c	0	0½
Price per foot run	0	2¾

For birdsmouthed roll add ¾d per foot for the labour to birdsmouth on underside or 3½d per foot run in all

Mitres to Ditto —Allow the value of one foot run of roll for these say 2¾d each

Casements Sashes and Sash Frames

Constants of Labour		Hours of a Joiner
Labour from bench 1½ in ovolo moulded casement single squares	per ft sup	30
Ditto ditto add for small squares		10
Ditto 2 in ditto single squares		35
Ditto add for small squares		25
Hanging casements 1½ in or 2 in		17

The words from bench mean that fixing or hanging is not included in the constant Take curved heads as twice that of straight Circular on plan ditto

		Hours of a Joiner
1½ in deal moulded or bevel bar sashes made and hung complete	per ft sup	45
2 in ditto ditto		60
Labour from bench deal cased frames with oak sunk sills and 1½ in sashes single hung		66
Ditto ditto double ditto		73
Ditto ditto 2 in sashes single ditto		78
Ditto ditto double ditto		90
Fixing deal-cased frames and sashes		07

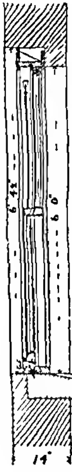
		Hours of a Joiner
Fixing fanlights or skylights	per ft sup	10
Labour from bench 1 in window linings rebated on edge		·25
Ditto 1¼ in window board with rounded nosings		16
Ditto 1¼ in jamb linings double rebated		45
Window linings 1 in two panel square framed back linings		·95
Ditto ditto bead butt or moulded		1·0
Ditto add for each panel above two		18
Ditto if moulded		·21
Ditto add if splayed		·0

Sashes and deal cased sash frames are usually taken together and are priced as one item but for the sake of simplicity they will be analysed separately

2 in bevelled or moulded Bar Sashes, and double hung with and including white Flax Line and Iron Weights (Pulleys will be taken with the frames)—Sashes will be dissected in the same manner as doors assuming a certain size and dividing by the number of superficial feet to get the price per square foot Taking an ordinary window opening 3 ft ... oak
s ... es
r ... is
c ... ble
t ... ng
c ... nd
sides (all 2 in × 2 in) can be cut out of half battens ... hs or 2½ in These widths it will be seen are sufficiently wide to admit of waste caused by saw cuts and planing

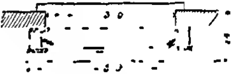
3 0 0 4½	1 2	Bottom rail				
3 0 0 4½	1 2	Meeting rails (two)				
3 0 0 2½	0 7	Top rail				
2 5 8 0 2½	2 1	Sides				
					s	d
	5 0	ft super of 2 in deal wrot B S	at 6d		2	6
	2?	ft run of rebate	at ¼d		0	5¼
	22	bevelling or moulding	at 1d		1	10
2 3 0	6	splay to meeting rails	at ¾d		0	4½
	3	bottom rail	at 1d		0	3
		Carried forward			5	5

	s	d
Brought forward	5	5
	0	1
	5	3
	0	8
	1	8
Labour hanging 2 hours joiner at 10½d	1	9
	14	10
Add 20 per cent profit &c	2	11
	17¾)17	9
Price per foot super	1	0



Section of Window

Small sashes casements and frames for same 12 ft super and under are worth 20 per cent more than larger ones The difference between single and double hanging is 2d per foot super All parts of windows can be finished by machinery and fitting or fixing is often the only work which a joiner has to do



Plan of Window

Deal cased Frames prepared for 2 in Sashes, with Oak sunk and weathered Sills grooved for iron Tongue and for Window Board if required 1 in Deal outside and inside Linings 2 in Heads 1¼ in Pulley Stiles tongued to inside and outside Linings ¾ in Parting Beads ¼ in Back Linings and Parting Slips the inside Beads 1¼ in wide and ¾ in thick double hung, and including and fixing brass Axle Pulleys and plugging to Wall—The analysis of this item will be about the most difficult the student will have to contend with and can only be understood by a frequent inspection of the drawings The size of external window opening is 3 ft × 6 ft, with 4½-in wall

rebate behind, giving 3 ft 9 in × 6 ft 4½ in, or 24 ft super of framing

The best and most suitable woods for use are Quebec red pine from the log and good quality Bjorneborgh from the batten The entire framing must be built according to the thickness of the sashes—in this case 2 in Battens of favourable widths and a profitable manner of conversion ought to be adopted to avoid excessive waste The cost of the cased frame complete will be worked out, and from this the price per square foot deduced as before

A good joiner can make per day one complete window frame and sashes of ordinary size, say for a 3 ft × 6 ft ope This includes ploughing tonguing putting together, &c but not hanging

					s	*d*
American oak sill				cut to size up to 9 ft cost per ft cube	4	0
				10 to 15 ft	4	6
				16 to 20 ft	5	0
3	9					
0	6					
0	3	0	6	ft cube 6 in × 3 in oak sill at 4*s*	2	0
3	9					
0	6	1	11			
2 3	9					
0	3	1	11			
		3	10	ft super planing on oak sill (bottom and sides) at 2*d*	0	8
		3	9	ft run rebate or check on top of sill at 1*d*	0	3¾
		3	9	ditto groove in bottom for iron tongue at ½*d*	0	2
		3	9	groove in side for window board at ½*d*	0	2
3	9					
0	6	1	11	ft super (batten width) for 2 in deal head w o s at 5¼*d*	0	10
2/3	0					
0	4½	2	3	outside and inside linings (top)		
2 2 6	4					
0	4½	9	6	(sides)		
		11	9	ft super 1 in deal w o s, at 3½*d*	3	5
2 6	0					
0	6	6	0	(batten width) for 1¼ in pulley stiles w o s at 4*d*	2	0
2 6	0					
0	6	6	0	back linings		
				Carried forward	9	6¾

					s	d
				Brought forward	0	6¾
25	0					
0	2½	2	1	parting slips		
		8	1	ft super ¾ in rough deal at 2*d*	1	4
3	0	3	0			
25	10	11	8			
		14	8	ft run ⅝ in wrot parting bead at ¼*d*	0	3¾
3	0	3	0			
25	9	11	6			
		14	6	ft run 1¼ in × ¾ in wrot inside bead at ½*d*	0	7¼
23	9	7	6	Grooving for head		
3	0	3	0	parting bead		
25	10	11	8			
220	6	2	0	pulley stiles		
220	0	21	0			
25	11	11	10	back linings		
3	0	3	0	inside lining		
26	4	12	8			
		76	5	ft run grooving in deal at ¼*d*	1	7
				Block and wedges say	0	4
			4	Brass axle pulleys 2 in at 1*s*	4	0
		3	6	ft run 1 in × ⅜ in G I tongue at 1*d*	0	3½
			1	lb white lead for bedding ditto and sill at 3½*d*	0	3½
Glass paper					0	1
Glue and nails					0	1
Putting together and cleaning up 6 hours joiner at 10½*d*					5	3
Labour fixing 2 hours joiner at 10½*d*					1	9
					25	5¾
Add 20 per cent profit &c					5	1¼
					21)30	7
Price per foot super					1	3

The following is a standard price in joiners machinery shops

Sash frame sashes glazed with 15 oz sheet glass, double hung, including metal pulleys sash weights sash lines, brass sash fastener all complete ready for fixing including priming coat at 1s per ft super

There are joinery firms who will also supply sashes and frames, ready made complete by machinery, for consider-

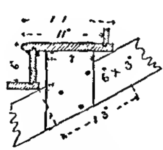
ably under the hand rate at 7s 6d each or 4½d to 6d per ft super delivered at any station within 150 miles

1¼ *in Window Board and Bearers*—These are wrought one side cross tongued with rounded edge and bearers For an ordinary window ope 3 ft wide externally, the size would be 3 ft 9 in × 5½ in, or say 2 ft sup including waste

	s	d
2 ft sup 1¼ in deal w o s, at 4d	0	8
4 ft run rounded edge at ½d	0	2
4 ft run cross tongued joint at ¾d	0	3
Bearers and nails 2 ft run at ¼d	0	[illegible]
Fixing ¼ hour joiner at 10½d	0	[illegible]
	1	5½
Add 20 per cent profit &c	0	3½
	2)1	9
Price per foot super	0	10½

Staircases

1¼ *in Treads with rounded Nosings and small Moulding* [illegible]



Stair Tread

One complete step should be detailed first and from this the cost per square foot found Assuming each step to be 4 ft long × 11 in × 6 in gives 6 ft super The included section of carriage which supports the tread and riser is measured on the slope

			s	d
4 0 1 1	4 1	Ft super 1¼ in deal tread, w o s, at 4d	1	5¼
4 0 0 6	2 0	" 1 in deal riser, w o s, at 3½d	0	7
2 4 0	8 0	Ft run grooving for riser at ¼d	0	2
2 4 0	8 0	" rebated edges for riser, at ¼d	0	2
	4 0	" rounded edge to 1¼ in tread at ¾d	0	3
	4 0	" moulding at 1d	0	4
	2 0	" deal blocking at 1d	0	2
4 0 1 4	5 4	Ft super planing up at 1d	0	5¼
2/1 3 0 6 0 3	0 4	Ft cube rough fir carriages framed at 2s 11½d	0	11¾
	1	Rough deal bracket 14 in × 7 in at 2d	0	2
Glue and nails			0	1
Fixing 6 ft super at 67 = 4 hours joiner at 10½d			3	6
			8	2¼
Add 20 per cent profit &c			1	7¾
			6) 9	11
		Price per foot super	1	8

Housing to tread and riser is priced separately, for which allow 3d per foot run, including fitting in and wedging

HANDRAILS

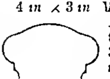
These are mostly made of mahogany of which the following are the dock sale prices in logs per foot sup as inch —

Mahogany	Spanish	1 in thick	per ft super	7d to 11d
	Honduras			6d „ 10d
	Mexican			5d „ 9d
	African		„	4d „ 8d

To the foregoing, however, must be added cost of sawing, waste and profit in conversion of 7½ per cent, so that the timber merchants charges would be —

				s	d	
Mahogany,	Spanish	1 in thick	per ft super	1	2	average
	Honduras,		„	1	0	„
	Mexican,	„	„	0	10	„
„	African,	„ „	„	0	8	„

4 *in* × 3 *in* *Moulded Honduras Mahogany Handrail, and Fixed* —As mahogany is valued according to the foot super at 1 in thick, the 4 in × 3 in section must be reduced to this denomination And as a joint and handrail screw may be assumed at every 10 ft, this length may be reasonably taken for the purpose of analysis and the cost per foot run thus ascertained 4 in wide × 3 in thick equals three 1 in thicknesses of 12 in × 4 in area per foot run, equal 1 ft super per foot run



Handrail

			s	d
10 1 0				
1 0	10 0	Ft super 1 in mahogany, at 1s	10	0
	10 0	Ft run sawing out at 3d	2	6
	10 0	moulding by machinery at 6d	5	0
Handrail screw and nut at joint			0	2
Labour to joint 1½ hours joiner at 10½d			1	3¾
fixing 10 ft 2			1	9
			20	8¾
Add 20 per cent profit &c			4	1¾
			10)24	10½
Price per foot run			2	6

Labour on mahogany handrail is equal 1½ times that on deal

Machine made handrails are much less than foregoing prices a similar one costing 80s per 100 ft run or 10d per ft run about half or third

Housing Ends of 4 *in* × 3 *in* *Mahogany Handrail* —This means horizontally into newel or woodwork A joiner can manage 3 in an hour

	d
⅓ hour joiner at 10½d	3½
Add 20 per cent profit &c	0½
Price of each	4

Ditto on rake are worth half as much again, or 6d each

Housings in Handrail to receive Balusters —A joiner can

do 4 per hour at 10½*d* in mahogany handrail, which with profit makes 3*d* each

2 *in turned Deal Balusters, Housed and Fixed*—Take length at 3 ft, and include housing and fixing

	s	*d*
3 ft run of 2 in × 2 in rough deal, at 1*d*	0	3
Labour turning ordinary pattern	0	6
Fixing ½ hour joiner, at 10½*d*	0	5
	1	2
Add 20 per cent profit &c	0	3
Price of each	1	5

Similar balusters, turned by machinery and ready made, can be obtained for about 4*s* per dozen or 4*d* each, according to pattern If of pitch pine 7*s* per doz, or 7*d* each

Curtail End to bottom Step and fixed—Sometimes the curtail block is made up of three pieces glued and screwed together, but here it is taken solid Frequently it is billed "*Extra* for solid curtail step, when less than half the following price would be sufficient

	s	*d*
Material say 1 ft cube of fir from balk	3	0
Making block 5 hours joiner at 10½*d*	4	4½
Fixing „ 1 „	0	10½
	8	3
Add 20 per cent profit &c	1	9
Price of each	10	0

SKIRTINGS

	s	*d*
100 ft run of 1 in × 9 in deal torus skirting	22	6
Waste on ditto 10 per cent	2	3
Nails 2½ in cut clasp 2 lbs at 1¼*d* per lb	0	2½
Cleaning up and fixing 15 hours joiner at 10½*d*	13	1½
	38	1
Add 20 per cent profit &c	7	7
	100)45	8
Price per foot run	0	5½

Skirting

Fitted ends are valued at ½ foot run of skirting
Housings are valued at 1 foot run of skirting
Mitred angles are valued at 1 to 1½ feet run of skirting

Rounded Ends to Skirting.—A joiner will do 5 in an hour at 10½*d* per hour wage = 2½*d* each, including profit.

Roofing Felt

Inodorous Asphalted Roofing Felt, including 2 in. Laps and fixed with Iron Clout Nails weighing 3 lbs. per thousand placed 3 in. apart.—The felt should be laid longitudinally from gable to gable the same way as the roof boarding—that is, to have the joints of the boards and the joints of the felt parallel, which allows a free expansion and contraction of the boards without disturbing the surface of the felt. McNeill's felts are some of the best in the market, and their prices are:—

		£	s.	d.
Inodorous or bituminous felt, for placing under slate, tile or metal roofs, in rolls 25 and 30 yds. long × 32 in. wide	per roll	1	0	0
	per yd. run	0	0	6
	per sq. ft.	0	0	1
[illegible]	[illegible]	1	0	0
		0	0	8
		0	0	1
	[illegible]	0	15	0
under slate, tile or metal roofs, is of the same character as last, but thinner, in rolls 25 and 30 yds. long × 32 in. wide	per yd. run	0	0	6
	per sq. ft.	0	0	0¾

From the foregoing a manufacturer's discount of 60 to 70 per cent. is taken off according to quantities ordered, but for ordinary merchant's discount reckon only half these percentages. With 2 in. lap a square would require four widths (each 32 in. or 2⅔ ft. width) each 10 ft. long = 4 × 2⅔ ft. × 10 ft. = say 107 ft. super of felt including waste. Average thickness, 3/16 in., and weight 6 to 7 ozs. per ft. sup.

The nails used are iron clout, about 1 in. long, weighing 3 to 4 lbs. per thousand. They cost 1s. 4*d*. per thousand, and should be dipped whilst hot in linseed oil, or if convenient heated in a shovel and thrown into grease, which prevents them from rusting afterwards. Galvanised clouts cost a trifle extra. At 3 in. apart allow 170 to the square, with waste.

	s.	d.
107 ft. inodorous felt at 1*d*. (less say 30 per cent. discount)	6	3
170 clout nails at 1s. 4*d*. per 1000	0	3
Labour laying 2 hours carpenter at 10½*d*.	1	9
	8	3
Add 20 per cent. profit, &c.	1	9
Total price per square ...	10	0

This is rather more than the ordinary contract price of 8*s* 4*d* per square or 1*d* per foot super

Mouldings

Numerous stock patterns are easily obtainable from the to fix an be

stock mouldings is often as much as 10 per cent off list prices

		s	*d*
4 in × 1 in architrave moulding red deal	per 100 ft run	9	0
3 in × 1 in		6	6
2½ in × ¾ in		4	6
2 in × ¾ in		3	0
3 in × 2 in moulded handrail		14	6
3½ in to 5 in girth moulding trade pattern		21	0
2½ in to 3 in		10	0
1½ in to 2 in		[illegible]	6

Special mouldings made according to working drawings are priced by the cubic foot and some estimators adopt the following scale which includes fixing and profit —

		s	*d*
2 in × 2 in and under	per ft cube	12	0
2 in × 2 in to 4 in × 3 in		8	0
Over 4 in × 3 in		6	0

3½ to 5 in girth Deal Moulding and Fixed If used as a dado or picture rail plugging to wall would be necessary Detail 100 ft and divide —

	s	*d*
100 ft run 3½ to 5 in girth deal moulding	21	0
Waste on do to 10 per cent	2	6
Wall plugs 18 in apart say 70 at ¾*d*	4	4½
2½ in cut clasp nails 2 lbs at 1¼*d* per lb	0	2½
Plugging and nailing 15 hrs carpenter at 10½*d*	13	1½
	41	1½
Add 20 per cent profit &c	8	4½
	100)[illegible]	
Price per foot run	0	6

For the value of mitres to mouldings it is usual to take a proportion of the price of a foot run, as 1 ft for ordinary mitres 2 ft for irregular mitres &c, and sometimes a percentage as 15 per cent on the rate per foot cube

Arch traves. Panel Mouldings

Holes cut and dished to w c Seat —This is merely labour and will take a joiner about 1½ hours to cut and finish.

	s	d
1½ hours joiner at 10½ d	1	3¾
Glas paper and profit	0	3¼
Price of each	1	7

Various Woods

Ash —Ash is seldom used by the builder but it makes good and durable gates works well into mouldings and delicate details can be polished and is suitable for hand rails small balusters &c It is however mostly employed for the handles of implements as it stands rough wear and tear on account of its elasticity The timber is economical to convert because of the absence of sap, but this should be done soon after the logs are felled otherwise deep shakes appear and instead a heavy loss will be involved

English ash costs about 3s 6d per ft cube in log or balk and 4s 9d ditto in scantling

Elm —This wood warps very much on account of the irregularity of its fibre and hence is used for plugs for driving into brickwork For this reason it should be [illegible] pieces should be cut just

[illegible] cube in balk and 4s 6d

Oak —There are several varieties of oak and the timber is very strong hard and tough but cracks and warps a great deal in seasoning This is especially the case with English oak which has been largely replaced by that of foreign growth It is said to require 3 years seasoning for every inch in thickness and even the oldest oak in ancient buildings will

shrink if replaned Foreign oak is preferable for internal
... or split
est kind
balk, and
ood deal

Memel
s, and is
s per ft
cube in balk, and 6s in scantling

			s	d
Dry wainscot	in logs costs	per ft sup as inch	0	10
,,	¾ in × 4½ in floorboards	per square	45	0
,,	1 in × 4½ in ,,	,,	50	0
,,	1¼ in × 4½ in ,,	,,	60	0

Dantzic oak is grown chiefly in Poland, and shipped at the port after which it is named, also at Memel and Stettin It makes excellent planks, being straight and clean in the grain, and is easily bent if boiled or steamed Dantzic and Memel oak cost £4 to £8 per load

Austrian or Hungarian oak, shipped from Trieste, is now plentiful in the market It costs 8s per f c, or 11*d* per f s, 1 in thick, when sawn into planks or converted

American oak is found from Canada to Carolina, and the variety mainly imported into this country from Quebec is the white oak, so called from the white colour of its bark Prices, for carpentry 3*s*, for joinery up to 5*s*, and in wainscot logs about 6*s*, all per f c

Labour on oak is 2 times that upon deal
Labour and material are 3 times the value of deal
Labour on oak circassing is ¼ more than fir
Labour to curved work is ½ more than to straight

Waste on oak in conversion, because of its liability to twist, may be taken at 10 per cent more than on deal equals 20 per cent in all for sawing and conversion Oak and Honduras mahogany joinery are supposed to be of equal value, but the *former* does not work so easily as the latter and there is more waste

To remove English grown timber costs 3*d* per foot cube for loading and carriage 4 miles and 1s 6*d* per ton by railway

Yellow Pine—This is otherwise known as Weymouth Pine, because it was first introduced by Lord Weymouth It is sometimes referred to as white pine from the colour of its bark The wood is light soft straight grained free from knots takes glue well and very easy to work Hence it is most suitable for joinery and fittings especially for

drawers and panels of doors being of a clear uniform yellowish colour. It is particularly in request for iron founders' patterns for castings. But the wood is not durable, especially when doated with minute grey specks or dots the result of disease. It grows in North America and that shipped from Quebec has the best reputation.

Yellow pine is imported both in logs and sawn into scantlings, while planks can be obtained up to 24 in. wide.

American yellow deals are classed as follows :—

Brights, 1st, 2nd and 3rd quality, which have been sawn from picked logs and have not been discoloured by being floated down the rivers, and are therefore of a cleaner or brighter yellow.

Dry Floated, 1st, 2nd and 3rd quality, which have been stacked and dried before shipment after being floated down.

Floated, 1st, 2nd and quality, which have been floated do

£5 to £10 per load

leals and battens is

termed *American* yellow deal (Seddon). But as stated on a former page yellow pine and yellow deal must not be confounded.

The prices at the dock sales would be :—

		Per St. Petersburg standard		
		£		£
Quebec yellow pine deals	1sts	34	to	44
	2nds	24		30
	3rds	16		20

ine deals from

sawing con

per foot cube

and for thicknesses :—

			s.	d.
Yellow pine ½ in. thick		per ft. sup.	0	2½
¾ in.			0	3½
1 in.			0	4½
1¼ in.			0	5½
1½ in.			0	7
1¾ in.			0	8
2 in.			0	9

Wooden Pattern for Stanchion

The following analysis will show how to arrive at the price of a yellow pine pattern (usually allowed for in a bill of quantities) for casting an iron stanchion.

A pattern maker's pay is 10*d* per hour, [illegible] varies from 7*s* upwards per day [illegible] stanchion pattern would occupy, [illegible] ½ hour per foot super of the stuff used, [illegible] additional per foot run for all rounded [illegible] filleted angles

The box on the top of the stanchion [illegible] hollow, and therefore it would be closed [illegible] put on the end to make an impression in the [illegible] the end of a "core," the weight of the other part [illegible] by a "chaplet." A very simple "core box" [illegible] mould would suffice, into which the sand could [illegible]

3	3	feet super 1 in yellow pine at 4½*d*	[illegible]	[illegible]
20	2	1¼ in 5½*d*	[illegible]	[illegible]
56	10	feet run arris fillets at ½*d*	[illegible]	[illegible]
3	3			
20	2			
23	5	feet super at ¼*d* for nails and screws	[illegible]	[illegible]
23	5	feet super × ½ hour = 11¾ hours pattern maker at 10*d*	[illegible]	7
96	3	feet run × $\frac{1}{12}$ hour = 8 hours ditto for shaped edges	[illegible]	[illegible]
			[illegible]	7½
		Add 20 per cent profit &c	[illegible]	[illegible]
		Total price of pattern	[illegible]	[illegible]

For *use only* of wooden pattern for cast iron column 5*s* is commonly put down and from one pattern many columns can be cast

Pitch Pine — The best of this timber comes from the southern United States through the ports of Georgia, Pensacola Darien Savannah &c It is heavy strong free from knots well marked full of resin but liable to shakes From its beauty of figure it is much in demand for joinery that is to be finished without paint especially as the resin prevents the paint from adhering properly Though the resinous matter makes the wood extremely durable it causes it to be sticky and difficult to plane Hence it is classed as a hard

wood and the cost of working is usually considered to be on an average 60 per cent more than on deal Old and dry pitch pine is particularly hard to work Sawing is charged at one third more than for deal

Pitch pine can be obtained 9 to 18 in square and from 20 to 65 ft long Being subject to heart shakes and cup-shakes it is more economical to purchase it in the form of planks when it has to be used in that way The cost a the docks is £5 to £6 per load or 2s 4d per f c in log

The following are the prices for thicknesses after conversion at 3s per f c in scantling —

		s.	d
Pitch pine ½ in thick	per foot sup	0	1½
¾ in		0	2
1 in		0	3
1¼ in		0	3½
1½ in		0	4½
1¾ in		0	5
2 in		0	6

The labour and material in pitch pine jamb linings wall strings skirtings seats doors framings newels handrails &c are 25 per cent more than in deal—sometimes 33 per cent Labour alone is 60 per cent more than for deal

Mahogany—This now comes from Cuba St Domingo Tabasco Honduras Mexico Panama and Africa

Cuba or Spanish mahogany is the best and most expensive It is beautifully figured with small white specks sound and of a yellowish colour when polished The logs are 20 to 36 ft long and from 12 to 24 in square It is the hardest the labour on it being about three times as great as that on yellow deal Good Cuba mahogany costs 50 per cent more than Honduras

St Domingo or Hayti mahogany is as good as Cuba hard and heavy but is smaller and getting scarce The logs do not exceed 10 ft in length and 18 in square

nted
for 30 ft
for than
Honduras

Honduras or Bay mahogany is found round the Bay of Honduras in great quantity It is sometimes called Bay wood The wood is of a reddish brown colour without figure and more coarse and even in grain than Spanish mahogany Honduras mahogany is the most easily worked and is chiefly shipped from Belize The logs are about 14 ft long and 2 to 4 ft square

Mexican mahogany possesses the same characteristics as that from Honduras The wood is coarse, spongy in the centre and liable to star shakes, and latterly the sizes have been small

Panama mahogany is also like Honduras, but short, badly shaped, and badly cut, shipped from Colon and Darien

African mahogany comes from the neighbourhood of Senegal, but although close and hard of texture, it is comparatively inferior The import, however, is increasing, [illegible] the stock [illegible] the pro [illegible] are up to [illegible] aking a firm hold of glue and it contains no acids [illegible] ich would be injurious to metal fastenings The qualities of the many varieties differ enormously in value, and the inferior kinds are frequently stained before polishing to pass muster

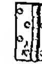
Mahogany is usually sold by the superficial foot of 1 in thick, broker s measure In selling by auction the trade custom is to charge for only 70 per cent of the cubical contents of the logs as the rest is supposed to be wasted in cutting into thicknesses As stated under Handrails the London dock sale prices are —

			d		*d*
Mahogany	Spanish 1 in thick	per ft sup	7	to	11
	Honduras		6		10
	Mexican		5		9
	Jamaican		4		7
	African		4		8

Teak The best teak is found in Burmah the two principal ports for shipment being Moulmein and Rangoon It also grows in India Java and Siam The colour is mostly a rich brown and the wood is strong and easily worked, somewhat resembling oak If not tooled with care it is very liable to splinter and it contains a resinous oil which makes it durable and tends to preserve iron fastenings The so called " African teak " is an inferior wood of quite a different kind Teak is coming more and more into building use being greatly employed for shop fittings joinery and sills for sash frames On account of the oil in the pores it makes a splendid floor for dancing The cost of working is about equal to Honduras mahogany or twice deal

The timber is sorted in the markets according to size, not

	s	d
3 in brass sash fastener at 19s per dozen	1	7
8 brass screws at 2s 3d per gross	0	1½
Fixing ⅓ hour joiner at 10½d	0	3½
	2	0
Add 20 per cent profit, &c	0	5
Price of each	2	5


Butt Hinges

Hinges—Hinges are fixed with the hanging of the doors, so that in *Ironmonger* they are supplied only Butt hinges are narrow, medium or broad Medium ones take 8 or 10 screws per pair, which should be 1¼ in or 1½ in long Cross garnet hinges are light or strong and require rather more screws


S Folk Thumb-Latch

Middling Suffolk Thumb latch, and Fixed—Good wrought iron latches of this description are catalogued at 13s per dozen, and need about a dozen screws for fixing

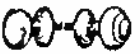
	s	d
S T thumb latch at 13s per dozen	1	1
1 dozen iron screws at 1s 3d per gross	0	1¼
Fixing 1 hour joiner at 10½d	0	10½
	2	0¾
Add 20 per cent profit &c	0	5¼
Price of each	2	6

7 in *Iron Rim Lock, including Brass Furniture, and Fixed*—Locks should be very accurately described, as they differ more than any other kind of ironmongery The full description for such a good lock would include fine ward, strong cranked tail box staple, and Mace's strong brass furniture The latter would embrace 2 in cast brass knobs with solid necks, cast rose and escutcheon, and wrought iron spindle Dead shot locks have no handle, but are actuated by a key only Locks in mechanism are also single bolt, two bolt, or three bolt, and having bushed wards, &c


Iron Rim Lock

	s	d
7 in iron rim lock at 42s per dozen	3	6
Mace's furniture, extra, at 8s per dozen	0	8
Iron screws not provided	0	1
Fixing, 1 hour joiner, at 10½d	0	10½
	5	1¼
Add 20 per cent profit, &c	1	0¾
Price of each	6	2

The furniture for mortise locks may be kept and priced separately, as it is generally selected by the architect For plain brass furniture, 3s per set is a fair price



Lock Furniture

A joiner can fix 4 mortise locks, 6 in × ¾ in,

y an effort he

From the foregoing typical cases it will be seen that the analysis of all ironmongery items merely consists of cost of the article, screws, and fixing, plus profit

CHAPTER XV.

SMITH AND IRON FOUNDER.

MEMORANDA

Cube Weights

Cast iron weighs 450 lbs per ft cube
Wrought iron „ 485 lbs „
Steel „ 490 lbs „

Cubic inches of wrought iron × 28 = lbs
„ ÷ 100 = qrs
„ „ „ ÷ 400 = cwt

Super Weights

1 ft super of wrought iron 1 in thick = 40½ lbs
„ cast iron „ = 37½ „
„ steel „ = 41 „
„ copper „ = 46 „
„ gunmetal „ = 46 „
„ brass „ = 45 „
„ lead „ = 59 „
„ tin „ = 38 „
„ zinc „ = 37½ „

Multiply by 12 to obtain the weight of foregoing per foot cube
Iron expands or contracts $\frac{1}{150000}$ of its length for every degree Fahr

Conversion of Weights

Weight of wrought iron × 93 = weight of zinc
× 93 = „ cast iron
× 94 = „ tin
× 1.02 = „ steel
× 1.09 = „ gunmetal
× 1.09 = „ brass
× 1.15 = „ copper
× 1.47 = „ lead

One rough rule to find the weight of castings is to multiply the weight pine pattern by 16 for cast iron, and by 17.6 for cast steel

Weight of Bolt Heads and Nuts

Description	Diameter of Bolt in Inches.								
	½	⅝	¾	⅞	1	1¼	1½	1¾	2
Hexagon head and nut	lb 128	lb 267	lb 43	lb 73	lbs 1.10	lbs 2.14	lbs 3.78	lbs 5.6	lbs 8.75
Square head and nut	164	320	55	98	1.31	2.56	4.42	7.0	10.50

Weight of bolt heads and nuts may be taken as equal to 3 in run of bolt

GAUGES FOR SHEET METAL WIRE ETC

Other gauges are employed in mechanical engineering but are not usually met with in ordinary building work

WROUGHT IRON SECTIONS

example a wrought iron T iron is 4 in × 3½ in × ½ in The area is 3¾ sq in, and—

$$\frac{3\,75 \times 10}{3} = 12\,5 \text{ lbs per lineal foot}$$

SHEET IRON—WEIGHT OF A SQUARE FOOT

S W Gauge	Thickness	Weight	S W Gauge	Thickness	Weight.
No	in	lbs	No	in	lbs
1	300	12 125	16	064	2 587
2	276	11 155	17	·056	2 263
3	252	10 185	18	048	1 940
4	232	9 377	19	0·0	1 617
5	212	8 468	20	·036	1 455
6	192	7 760	21	·032	1 293
7	1"6	7 113	22	028	1 132
8	160	6 467	23	·0?4	970
9	144	5 820	24	·0?2	889
10	128	5 173	25	020	808
11	116	4 688	26	018	727
12	104	4 203	27	·016	663
13	·092	3 718	28	·014	598
14	080	3 233	29	·013	550
15	·072	2 910	30	012	501

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Wrought iron 485 lbs.
Steel 490 lbs

Cubic inches of wrought iron × ·28 = lbs
÷ 100 = qrs
÷ 400 = cwt

Super Weights

1 ft super of wrought iron 1 in thick	= 40⅛ lbs
cast iron	= 37½
steel	= 41
copper	46
gunmetal	= 46
brass	= 45
lead	= 59
tin	= 38
zinc	= 37½

Multiply by 12 to obtain the weight of foregoing per foot cube
Iron expands or contracts $\frac{1}{150000}$ of its length for every degree Fahr

Conversion of Weights

We gh f = h oz

Weight of Bolt Heads and Nuts

Description	Diameter of Bolt in Inches								
	½	⅝	¾	⅞	1	1¼	1½	1¾	[illegible]
Hexagon head and nut	lb 128	lb 267	lb 43	lb 73	lbs 1 10	lbs 2 14	lbs 3 78	lbs 5 6	lbs 8 75
Square head and nut	164	320	55	88	1 31	2 56	4 42	7 0	10 50

Weight of bolt heads and nuts may be taken as equal to 3 in [illegible] of bolt

GAUGES FOR SHEET METAL, WIRE, ETC

Standard Wire Gauge —This is the recognised legal standard gauge, as authorised by the Board of Trade from 1st March, 1884 and expressed by the letters ' S W G ' or sometimes simply "W G ' It is likewise named the Imperial Standard Wire Gauge (I S W G), or British Standard Gauge (B S G), or merely Standard Gauge

Other gauges are employed in mechanical engineering, but are not usually met with in ordinary building work

WROUGHT IRON SECTIONS

[illegible]

example, a wrought iron T iron is 4 in × $3\frac{1}{2}$ in × $\frac{1}{2}$ in. The area is $3\frac{3}{4}$ sq in, and—

$$\frac{3\,75 \times 10}{3} = 12\,5 \text{ lbs per lineal foot}$$

SHEET IRON—WEIGHT OF A SQUARE FOOT

S W Gauge	Thickness	Weight	S W Gauge	Thickness	Weight.
No	in	lbs	No	in	lbs
1	300	12 125	16	064	2 587
2	276	11 155	17	056	2 263
3	252	10 185	18	·048	1 940
4	232	9 377	19	040	1 617
5	212	8 468	20	036	1 455
6	192	7 760	21	032	1 293
7	176	7 113	22	028	1 132
8	160	6 467	23	024	·970
9	144	5 820	24	022	889
10	128	5 173	25	·020	808
11	116	4 688	26	018	727
12	104	4 203	27	·016	663
13	·092	3 718	28	·014	598
14	080	3 233	29	·013	550
15	·072	2 910	30	012	501

ROUND AND SQUARE WROUGHT IRON—WEIGHT OF A LINEAL FOOT

Wrot Iron	Diameter or Side in Inches											
	¼	½	¾	1	1¼	1½	1¾	2	2¼	2½	2¾	3
	lb	lb	lbs	lbs	lbs	lbs	lbs	lbs	lbs	lbs	lbs	lbs
Round	165	661	1 49	2 65	4 13	5 96	8 10	10 58	13 39	16 53	20 20	23 80
Square	210	842	1 90	3 37	5 26	7 58	10 32	13 47	17 05	21 05	25 47	30 31

FLAT BAR IRON—WEIGHT OF A LINEAL FOOT

Width in Inches	Thickness in Inches								
	1/16	⅛	¼	⅜	½	⅝	¾	⅞	1
	lb	lbs	lbs	lbs	lbs	lbs	lbs	lbs	lbs
1/16	0132	0263	0526	0789	1053	1316	1579	1843	2105
⅛	0264	0526	1053	1579	2105	2631	3158	3684	4210
¼	0526	1053	2105	3158	4210	5264	6315	7368	8420
⅜	0789	1579	3158	4736	6315	7894	9473	1 105	1 263
½	1053	2105	4210	6315	8420	1 053	1 263	1 471	1 684
⅝	1316	2631	5263	7894	1 053	1 316	1 579	1 842	2 105
¾	1579	3158	6315	9473	1 263	1 579	1 895	2 210	2 526
⅞	1842	3684	7368	1 105	1 474	1 842	2 210	2 579	2 947
1	210	421	842	1 274	1 684	2 105	2 526	2 947	3 368
1½	316	632	1 263	1 895	2 526	3 158	3 789	4 421	5 052
2	421	842	1 684	2 526	3 368	4 210	5 052	5 894	6 736
2½	526	1 053	2 105	3 159	4 210	5 263	6 315	7 368	8 420
3	632	1 263	2 526	3 789	5 052	6 315	7 578	8 841	10 104
3½	737	1 474	2 947	4 421	5 894	7 368	8 841	10 315	11 789
4	842	1 684	3 368	5 052	6 736	8 420	10 101	11 789	13 472

Sheet Metal—Weight of a Square Foot.
(Birmingham Wire Gauge)

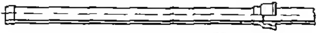
B W G	Iron	Copper	Brass	B W G	Iron	Copper	Brass
No	lbs	lbs	lbs	No	lbs	lbs	lbs
1	12 50	11 50	13 75	16	2 50	2 90	2 75
2	12 00	13 90	13 10	17	2 18	2 52	2 40
3	11 00	12 75	12 10	18	1 86	2 15	2 04
4	10 00	11 60	11 00	19	1 70	1 97	1 87
5	8 74	10 10	9 61	20	1 54	1 78	1 69
6	8 12	9 40	8 93	21	1 40	1 62	1 54
7	7 50	8 70	8 25	22	1 25	1 45	1 37
8	6 86	7 90	7 54	23	1 12	1 30	1 23
9	6 24	7 20	6 86	24	1 00	1 16	1 10
10	5 62	6 50	6 18	25	90	1 04	99
11	5 00	5 80	5 50	26	80	92	88
12	4 38	5 08	4 81	27	72	83	79
13	3 75	4 34	4 12	28	64	74	70
14	3 12	3 60	3 43	29	56	64	61
15	2 82	3 27	3 10	30	50	58	55

Cast iron Socket and Spigot Pipes.

Medium Weight—For a head of water 600 ft and under—

Bore	Length when laid	Length of Socket	Thickness of Metal	Weight of each Pipe	Size of Lead Joint	Weight of Lead Joint	Length of Yarn.
in	ft	in	in	lbs	in × in	lbs	ft
2	6	3	$\frac{11}{32}$	56	$1\frac{1}{2} \times \frac{1}{4}$	1 5	$2\frac{1}{4}$
3	9	$3\frac{1}{2}$	$\frac{3}{8}$	123	$1\frac{1}{2} \times \frac{5}{16}$	2 5	3
4	9	$3\frac{1}{2}$	$\frac{3}{8}$	161	$2 \times \frac{5}{16}$	4 0	4
5	9	4	$\frac{13}{32}$	216	$2 \times \frac{3}{8}$	5 0	$4\frac{1}{2}$
6	9	4	$\frac{7}{16}$	277	$2\frac{1}{4} \times \frac{3}{8}$	6 5	$5\frac{1}{2}$
7	9	$4\frac{1}{4}$	$\frac{15}{32}$	345	$2\frac{1}{4} \times \frac{3}{8}$	7 7	$6\frac{1}{2}$
8	9	$4\frac{1}{4}$	$\frac{1}{2}$	417	$2\frac{1}{2} \times \frac{3}{8}$	9 0	7
9	9	$4\frac{1}{2}$	$\frac{9}{16}$	528	$2\frac{1}{2} \times \frac{3}{8}$	10 5	8
10	9	$4\frac{1}{2}$	$\frac{19}{32}$	640	$2\frac{1}{2} \times \frac{3}{8}$	13 0	9
12	9	$4\frac{1}{2}$	$\frac{5}{8}$	775	$2\frac{1}{4} \times \frac{7}{16}$	18 2	11
15	12	$4\frac{1}{2}$	$\frac{11}{16}$	1 377	$2\frac{1}{4} \times \frac{7}{16}$	22 2	14
18	12	$4\frac{1}{2}$	$\frac{7}{8}$	2 107	$2\frac{1}{4} \times \frac{5}{8}$	26 6	17

Plain Socket and Spigot Pipe



Socket and Spigot Pipe with turned and bored joint

Laying Cast iron Water Pipes

Laying cast iron water pipes exclusive of digging Labour and materials per length of 9 ft = 3 yds run —

	3 in	6 in	9 in	12 in
Gasket lbs	15	25	35	45
Lead lbs	2·50	6·50	10·50	18·00
Coals cwt	·03	·04	·05	·06
Smith and labourer hrs	1·75	2·00	2·25	2·50
3)				
Per yd run				

Weights of Gutters Rainwater Pipes, Soil Pipes and Ventilating Pipes

Description.		3 in	3½ in	4 in	4½ in	5 in.	6 in.
	Per 6 ft length	lbs	lbs	lbs	lbs	lbs	lbs.
Half round cast iron Gutters		9	11	13	15	17	23
Ogee plain cast iron Gutters		13	14	16	18	20	26
Round cast iron Down Pipes		26	31	36	42	50	68
Cast iron Soil Pipes ¼ in metal		48	54	60	70	80	96
Cast iron Ventilating Pipes $\frac{3}{16}$ in metal		37	43	48	54	60	73

Weights are exclusive of joints bolts and nuts brackets screws holdfasts &c

Corrugated Iron Roofing

Is usually made in sheets 6 ft to 9 ft long and 2 ft to 3 ft wide

S W Gauge	Size of Sheets.	Weight per Square as laid	Square Feet per Ton before laying
No	ft ft ft ft	lbs	ft s
16	6 × 2 to 8 × 3	363	746
18	6 × 2 to 8 × 3	274	957
20	6 × 2 to 8 × 3	203	1 355
22	6 × 2 to 7 × 2½	163	1 538
24	6 × 2 to 7 × 2½	140	1 866
26	6 × 2 to 7 × 2½	112	2 354

for each side Sheets should
and be double bolted at the
should be given

gations are usua h but

PRICES

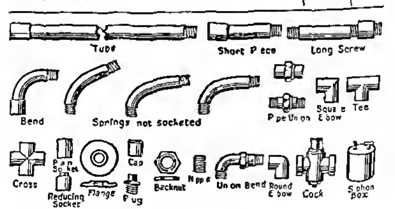
Wrought Iron.

Wrought iron, best Staffordshire, in bar, plate, or hoop, and to be of any pattern The prices include all drilling, punching, countersinking for screws, filing, &c

Description		Supplied only s	d	Add if Fixed s	d
Angle and tee iron bars	per lb	0	3	0	0¼
Balusters and newels, shouldered countersunk, [illegible]	"	0	4	0	0½
[illegible]	each	2	0	—	
[illegible]	per lb	0	2¼	0	0¼
[illegible]		0	3	0	0½
[illegible]	each	0	6	—	
[illegible] riveting, or for fixing into stone or brick work, or to wood with screws	per lb	0	3¼	0	0¼
Bolts with hooks or rings at one end and prepared for riveting or jagged or lewised at the other end including washers, under [illegible]	"	0	4½	0	2½
[illegible]	"	0	4	0	2
[illegible]	"	0	3½	0	1½
[illegible]	"	0	3	0	1
[illegible]		0	5	0	2½
Ditto, 1 lb and under 2 lbs ditto	"	0	4	0	2
Ditto, 2 lbs " 4 lbs "	"	0	3½	0	1½
Ditto, 4 lbs " 8 lbs "	"	0	3	0	1
Bolts for gutters 1½ in long and under with head, screw, and nut	per doz	0	6	0	6
Bolts, running for doors or gates home made, on plate above 12 in long including hasps, staples, thimble &c	per lb	0	5	0	1½
Brackets for eaves gutters shelves, &c.	"	0	4	0	1
Cramps	"	0	2½	0	0¼
Fishplates bands &c	"	0	3	0	0½
Dog irons	"	0	2½	0	0½
Framing of angle tee or bar iron, &c, as in iron buildings, including all fitting drilling, bolts, &c	per cwt	18	0	2	0
Gratings framed or of plate iron, perforated, straight or curved, for drains, ventilators, [illegible]	per lb	0	4	0	0½
[illegible]	"	0	3½	0	0½
[illegible]	"	0	1	—	
[illegible] sunk, &c	"	0	2½	0	0½
Holdfasts rings stay hooks, &c, ½ lb each and under, japanned	"	0	3	0	1

PRICES OF WROUGHT IRON—*continued*

Description		Supplied only		Add if Fixed	
		s	*d*	*s*	*d*
Iron ladders framed and riveted with lewis or other bolts for securing	per lb	0	4	0	1
Rails hand half round drilled for balusters and screws level or raking	,,	0	3½	0	0½
Rings manger with nuts and rivets &c		0	7	0	1½
Rope wire galvanised	per cwt	23	0	4	0
Sashes wrought and rolled iron with moulded or bevelled bars under 20 ft super		33	0	2	0
Steel or wrought iron in rolled joists angle or tee iron stanchions &c cut to length including holes for bolts or bars		13	6	3	0
Scrolls to handrails extra only	each	1	10	0	6
Screws stove ¾ in long	per doz.	0	1½	0	4
1 in		0	2	0	5
1½ in		0	3	0	6½
Shoes straps or rings for piles including nails	per lb	0	3	0	0½
Straps bolts nuts keys wedges &c for roof trusses		0	3½	0	0½
Strap hinges or hook and eye bolted with bolts taken elsewhere		0	5	0	1
Wrought iron or mild steel in roof trusses with bolts nuts plates &c	per cwt	22	0	3	0
Purlins and rafters of angle or tee iron fitted complete or tie rods screwed and fitted		16	0	2	6
	r ft sup	0	7	0	2
		0	6	0	2
		0	5	0	2
Ditto ditto No 21 to 24		0	4	0	2
Cutting corrugated iron to rake and waste	per f r	—		0	2



Wrought iron Pipes or Tubes

PRICES OF WROUGHT IRON—*continued*

		s	*d*
Wrot iron and steel sashes with small squares, weighing 6½ to 7 lbs. per f.s, from 1s to	per f s	2	0
Fixing only stirrup straps, 4 ft 6 in long	each	0	6
" " gibs and cotters	per set	0	6
" " [illegible]	each	0	2
[illegible]	"	10	0
[illegible]	"	2	3

GALVANISED PIPING

(Trade discount deducted)

Internal Diameter	½ in.		¾ in		1 in		1¼ in		1½ in		2 in	
Weight per Foot Run	1·06 lb		1 5[illegible] lb		[illegible] lb		3 [illegible] lb		3 90 lb		5 43 lb.	
	s	*d*	*s*	*d*	*s*	*d*	*s*	*d*	*s*	*d*	*s*	*d*
Galv W I welded pipe with plain screwed socket from 2-ft to 12-ft lengths, supplied only per ft run	0	3	0	4	0	6	0	8	0	10	1	1
Add if fixed including hooks, red lead, &c per ft run	0	2½	0	3	0	3½	0	4	0	4½	0	5
Add for covering pipes with two layers of stout hair felt secured with wire per yd run	0	7	0	8	0	9	0	11	1	1	1	3
Short piece under 2 ft, supplied only each	0	6	0	8	0	11	1	2	1	6	2	0
Connecting pieces or long screws supplied only each	0	8	0	10	1	1	1	6	1	11	2	8
Bends, elbows, or springs, supplied only each	0	6	0	8	0	11	1	4	1	9	2	7
Tees, equal or diminishing supplied only each	0	6	0	8	0	10	1	2	1	6	2	5
Crosses, equal or diminishing supplied only each	1	0	1	3	1	7	2	0	2	5	3	10
Sockets nipples caps plugs nuts, supplied only each	0	3	0	3½	0	4½	0	6	0	8	1	0
Brass barrel union joints for iron pipe, supplied only each	1	6	2	4	3	4	5	0	6	9	10	0
Brass barrel union joints for steam pipe, supplied only each	2	10	3	8	4	9	6	4	8	6	12	0
Add to last eight items if fixed each	0	2½	0	3	0	3½	0	4	0	4½	0	5
Galv iron hooks for piping per 100	1	6	2	4	2	10	3	9	4	10	6	0
Taking down old pipes per f r	0	1	0	1	0	1	0	1½	0	1½	0	2

Deduct 10 per cent, if butt welded pipes are used instead of lap welded

Iron Founder

Soft grey iron from the second melting cast sound and clean Prices include patterns and moulds

Description		Supplied only s	d	Add if Fixed s	d
In sand as furnace bars sash weights and similar articles kept in ordinary stock	per cwt	9	0	1	0
Backs and boilers for ranges grates &c		12	0	1	6
Balusters plain or ornamental drilled and tapped or with pin		15	6	2	0
Cisterns tanks &c in one piece		10	6	1	0
Ditto put together with screw bolts and nuts including iron cement or red lead		11	0	2	6
In solid columns plates washers joists posts girders &c and drilling		10	6	2	0
In hollow columns with caps and bases lamp posts heel posts &c		11	6	2	6
[illegible]		16	0	3	0
purpose made not kept in stock		5	0	2	0
Furnace fronts soot doors steam flues ovens dampers &c with W I fastenings		16	0	2	0
Gratings and frames for drains stoves &c		11	0	1	0
hinged		12	6	1	0
perforated for ventilators		14	0	1	0
Heads and shoes for roof trusses including drilling		13	6	2	0
Pipes of any thickness or length 1 to 24 in bore socket joints		8	0	1	6
Add if with turned and bored spigots and sockets		1	0	0	3
Pipes with flanged joints and fitted for screw bolts and nuts		10	0	2	0
Branches bends tee pieces collars caps &c extra only to price of pipes		5	0	0	6
Sashes and frames skylights and lantern lights square or circular		23	0	2	0
Socket shoes with tenons for door frames drilled and counter sunk	per lb	0	2½	0	0½
Ditto ditto for 5-in × 4 in door frame, 4 lbs.	each	1	0	0	4

		s	d
Cast iron ornamental cantilever brackets 3 ft × 3 ft weighing 63 lbs each bolted and fixed to iron columns &c	each	20	0
Pattern for ditto to serve for right or left		10	0
Pattern for cast iron column 8 ft 6 in long 3½ in diameter		15	0
Jones galvanised iron manhole cover and frame 24 in × 17 in supplied only		48	6
Ditto ditto 26 in × 20 in ditto		60	0

Gutters and Rainwater Pipes

Eavesgutters Rainwater Pipes &c	Supplied only including holdfasts spikes brackets bolts and nuts								Add if fixed including joints	
	3 in		3½ in		4 in		5 in			
	s	*d*	*s*	*d*	*s*	*d*	*s*	*d*	*s*	*d*
Rainwater gutters semi circular per ft run	0	3	0	4	0	5	0	7	0	3
Ditto ogee	0	4	0	5	0	6	0	8	0	3
Ditto pipes round	0	7	0	8	0	10	1	1	0	2
Ditto hopper heads flat each	1	10	2	1	2	5	4	0	0	5
Perforated covers for heads	0	8	0	10	1	0	1	3	0	2
Add *extra* to pipes for shoes bends swan necks 6 in offset &c	1	0	1	3	1	6	2	6	0	5
Ditto to gutters for angles or bends	0	7	0	8	0	9	0	11	0	4
Ditto ditto for stopped ends	0	4	0	5	0	6	0	8	0	4
Ditto ditto for nozzles or outlets	0	7	0	8	0	9	0	11	0	4
Clips for rain water gutters	0	3	0	4	0	5	0	7	0	3
Ditto ditto lionheaded	0	5	0	6	0	7	0	9	0	3
Copper wire hemispherical gratings over outlets in eavesgutters to down pipes	0	6	0	7	0	8	0	10	0	2
Galvanised iron wire ditto ditto	0	3	0	4	0	5	0	7	0	2
Strainers for heads of rainwater pipes	0	5	0	6	0	7	0	9	0	2

Soil Pipes &c

Soil Pipes &c	Supplied only		Add if Fixed	
	s	*d*	*s*	*d*
[illegible] per lb	0	2½	0	0½
[illegible] run with lead when fixed per ft run	1	0	0	6
4 in cast iron ventilating pipes weighing [illegible]	0	10	0	5
[illegible] each	1	4	0	3
[illegible]	0	9	0	3
[illegible]	1	6	1	6
[illegible]	1	0	1	4

Iron Founder

Soft grey iron from the second melting cast sound and clean Prices include patterns and moulds

Description		Supplied only s d	Add if fixed s d
In sand as furnace bars sash weights and similar articles kept in ordinary stock	per cwt	9 0	1 0
Backs and boilers for ranges grates &c		12 0	1 6
Balusters plain or ornamental drilled and tapped or with pin		15 6	2 0
Cisterns tanks &c in one piece		10 6	1 0
Ditto put together with screw bolts and nuts including iron cement or red lead		11 0	2 6
In solid columns plates washers joists posts girders &c and drilling		10 6	2 0
In hollow columns with caps and bases lamp posts heel posts &c		11 6	2 6
		16 0	3 0
purpose made not kept in stock		5 0	2 0
Furnace fronts soot doors steam flues ovens dampers &c with W I fastenings		16 0	2 0
Gratings and frames for drains stoves &c		11 0	1 0
hinged		12 6	1 0
perforated for ventilators		14 0	1 0
Heads and shoes for roof trusses including drilling		13 6	2 0
Pipes of any thickness or length 1 to 24 in bore *socket joints*		8 0	1 6
Add if with turned and bored spigots and sockets		1 0	0 3
Pipes with flanged joints and fitted for screw bolts and nuts		10 0	2 0
Branches bends tee pieces collars caps &c extra only to price of pipes		5 0	0 6
Sashes and frames skylights and lantern lights square or circular		23 0	2 0
Socket shoes with tenons for door frames drilled and counter sunk	per lb	0 2½	0 0½
Ditto ditto for 5 in × 4 in doorframe, 4 lbs	each	1 0	0 4

		s d
Cast iron ornamental cantilever brackets 3 ft × 3 ft		
olumns &c	each	20 0
		10 0
ng 3½ in		15 0
Jones galvanised iron manhole cover and frame 24 in × 17 in supplied only		48 6
Ditto ditto 26 in × 20 in ditto		60 0

Gutters and Rainwater Pipes

Eavesgutters, Rainwater Pipes &c.	Supplied only incl [illegible] spikes brackets bolts and nuts								Add if fixed including joints	
	3 in		3½ in		4 in		5 in			
	s	d	s	d	s	d	s	d	s	d
Rainwater gutters semi circular per ft run	0	3	0	4	0	5	0	7	0	1
Ditto ogee	0	4	0	5	0	6	0	8	0	3
Ditto pipes round	0	7	0	8	0	10	1	1	0	2
Ditto hopper heads flat each	1	10	2	1	2	5	4	0	0	5
Perforated covers for heads	0	8	0	10	1	0	1	3	0	1
Add *extra* to pipes for shoes bends swan necks 6-in offset &c	1	0	1	3	1	6	2	6	0	5
Ditto to gutters for angles or bends	0	7	0	8	0	9	0	11	0	4
Ditto ditto for stopped ends	0	4	0	5	0	6	0	8	0	4
Ditto ditto for nozzles or outlets	0	7	0	8	0	9	0	11	0	4
Clips for rain water gutters	0	3	0	4	0	5	0	[illegible]	0	3
Ditto ditto lionheaded	0	5	0	6	0	7	0	9	0	3
Copper wire hemispherical gratings over outlets in eavesgutters to down pipes	0	6	0	7	0	8	0	10	0	2
Galvanised iron wire ditto ditto	0	3	0	4	0	5	0	7	0	2
Strainers for heads of rainwater pipes	0	5	0	6	0	7	0	9	0	2

Soil Pipes &c

Soil Pipes &c	Supplied only		Add if Fixed	
	s	d	s	d
[illegible] per lb	0	0½	0	0½
[illegible] run with lead when fixed per ft run	1	0	0	6
4 in cast iron ventilating pipes weighing 48 lbs per 6-ft length ditto	0	10	0	5
[illegible] each	1	4	0	3
[illegible]	0	9	0	3
[illegible]	1	6	1	6
[illegible]	1	0	1	4

Soil Pipes, &c —*continued*

Soil Pipes, &c		Supplied only	Add if Fixed
		s d	s d
Leaded joints to 4 in cast iron socket soil	each	—	1 2
tinned end	,,	5 0	7 0
Ducksfoot bend for 4 in soil pipe, with base-plate 12 in square, weighing 44 lbs each	,,	10 0	2 6
Branches for cast iron soil pipe, single, weighing 24 lbs each, including 1 joint	,,	4 6	2 0
Branches for cast-iron soil pipe, double, weighing 34 lbs each, including 2 joints ..	,,	6 0	3 6

		s d
Taking down gutters, pipes, &c, and removing to store and stacking	per ft. run	0 1

Cast iron Soil Pipe

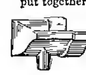
Bend for Soil Pipe

Single Branch

Double Branch

Moulded Gutters

		s d
5-in × 4 in cast iron moulded eavesgutter, weighing 20 lbs per 6 ft length, with plain faucet joints put together with screw bolts and red lead joints, and drilled for and fixed to deal fascia, including 1¼ in stout screws, No 3 to each 6 ft length	per ft run	1 1
Extra for stopped ends to ditto ...	each	0 9
,, internal or external angles	,,	1 3
,, outlets or nozzles	,,	1 3



Drop End

Stove Pipes

		s	d
4 in cast iron stove pipe weighing 34 lbs per 6 ft length and jointing in red lead fixing and passing into flue	per ft run	1	0
Bends for ditto weighing 14 lbs each and fixing	each	3	6
Elbows with cleaning doors 9½ lbs each and fixing		3	0

Water Pipes

		s	d
	per cwt	7	0
		5	0
	per yd run	1	0
	each	2	6
		4	6
		7	6
		4	0
		4	0
		35	0
		40	0
		4	0
		20	0
		3	0
screw-down valve hydrants		10	0
surface boxes for ditto		3	0
		2	0
pipes inside and out	per yd run	0	3
Ditto pipes 2 to 4 in diam ditto		0	2
Ditto pipes under 2 in ditto		0	1
Galvanising large articles 28 lbs and over	per cwt	8	0
small articles under 28 lbs		10	6

Holes in Pipes

Holes in Pipes	Internal Diameter of the Pipes											
	½ in.		¾ in		1 in		1¼ in		1½ in		2 in	
	s	d	s	d	s	d	s	d	s	d	s	d
Drilling holes in cast iron pipes &c for connections cocks &c each	0	3½	0	4½	0	5	0	6	0	7	0	8
Tapping ditto	0	3½	0	4½	0	5	0	6	0	7	0	8

Holes in Iron

Holes in Iron		Depth of Hole not exceeding									
		¼ in		⅜ in		½ in		¾ in		1 in	
		s	d	s	d	s	d	s	d	s	d
Holes drilled and countersunk in iron ¼ in to ¾ in diameter	each	0	1	0	1½	0	2	0	3	0	4
Ditto ¾ in to 1 in diam	„	0	1½	0	2¼	0	3	0	4½	0	6
Add to the above if tapped ¼ in to ⅝ in diam		0	1	0	1½	0	2	0	3	0	4
Ditto ⅝ in to 1 in diam	„	0	1½	0	2¼	0	3	0	4½	0	6

If holes drilled or tapped in position, double the foregoing rates

		s.	d.
Holes punched through sheet iron up to No 6 S W G	each	0	0¼
and countersunk ditto	„	0	0½
Cutting rounded corners or notches up to 3 in girth in ½ in W I plates	„	0	0½
Ditto in ¾ in plates	„	0	1
Turning or boring wrought iron, steel brass or gun metal	per sq in	0	1
Turning or boring cast iron	„	0	1½
Planing or fair facing iron or steel	„	0	0½

Stoves and Ranges

		£	s	d
Gurney stove size A to warm room of 120 000 c ft., and burning 10 lbs. of fuel per hour, weighing 23 cwt each, s.o	each	36	0	0
Ditto size B to warm room of 70 000 c. ft, and burning 9 lbs of fuel per hour, weighing 14 cwt 3 qr each s o	„	25	0	0
Ditto size C to warm room of 30,000 c ft., and burning 6 lbs of fuel per hour, weighing 8 cwt. 14 lbs. each s.o	„	15	10	0
Galton's ventilating grate 36 in × 35 in., heats 2,500 c ft s o	„	5	0	0
Self-acting London cottage range, oven and boiler 36 in s o	„	1	10	0
Improved London kitchen range, oven and boiler 48 in., s o	„	5	0	0
Extra strong "Leamington" range oven and boiler 60 in., s.o	„	11	0	0
The Self setter kitchen range oven and boiler, 36 in s.o		4	15	0
The Housewife stove oven and boiler, 35 in. long without utensils, s o	„	4	10	0

Trade discount for ranges and stoves 20 to 25 per cent off foregoing

VENTILATORS

Arnott's ventilators, bronzed or lacquered, small size, 11 in. × 8 in., s.o. each

Ditto, ditto, large size 16 in. × 9 in., s.o. — 11 0

Boyle's mica flap outlet ventilators, plain iron s.o

Size of front — Size of box

11 in. × 5 in. — 9 in. × 3 in. — 4 0

11 in. × 7 in. — 9 in. × 5½ in. — 6 0

11 in. × 9 in. — 9 in. × 7½ in. — 7 0

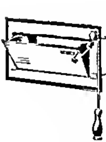

Mica Flap Ventilator

Boyle's latest patent "Air Pump" soil pipe ventilator 8 in. diam. head, 4 in. diam. pipe, galvanised and painted Design No. 225 s.o. — 11 6

Ditto ditto, cheap form Design No. 227 s.o. — 10 6

Boyle's latest patent "Air Pump" ventilator Design ... — 55 0

2 2
5 0
8 6
5 0
10 6
16 6


Sheringham's Ventilator

Ditto ditto 9 in. × 6 in. s.o — 4 0

Ditto, ditto, 13½ in. × 6 in. s.o — 5 6

Sanitary mica valve inlet ventilator spigot for 4 in. iron ventilating pipe s.o — 7 6

Iron wire guards for windows and sky lights lattice pattern, ½ in. to ¾ in. mesh, s.o — 10 0

Add if galvanised after manufacture — per ft. sup. 0 9

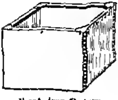
Fly wire or wire gauze under ½ in. mesh s.o — 0 2

— " 1 1

Add to foregoing, if fixed — 0 2

CISTERNS

	£	s	d
each	1	1	0
"	1	14	0
	2	13	6
	3	12	0
	4	5	6
	5	0	0
	6	0	0

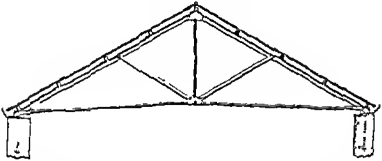


Wrot iron Cistern

CISTERNS—*continued*

Hoisting and fixing cisterns in position	each 3*s* to 15*s*
Foregoing cisterns by unit of capacity	per gal, 5*d* , 8*d*
Add if covered in top	1*d* 2*d*
Iron sliding door 7 ft × 4 ft with ¼ in plates stiles and rails ⅜ in thick, guide, channel runner bar, hangers cast iron bored wheels steel pins handle hasp &c, supplied only	„ 6 0 0

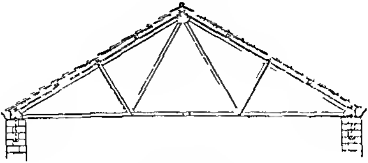
STEEL ROOF TRUSSES



King rod Roof

Spans 18 to 25 ft Steel principals 8 to 10 ft apart when carrying slates or tiles and 12 to 14 ft apart when covering is corrugated iron

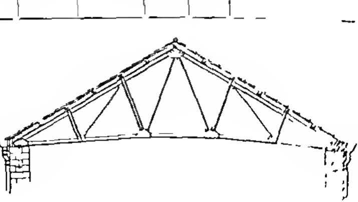
Span	T Rafters			T Struts			King Rod	Tie Rods		Weight			Price		
ft	in	in	in	in	in	in	in	in	in	cwt	qrs	lbs	£	s	d
18	2½ ×	2½ ×	¼	2 ×	2 ×	¼	¾	⅝	⅝	3	0	7	2	10	0
20	2½ ×	2½ ×	$\frac{5}{16}$	2 ×	2 ×	¼	⅞	¾	¾	3	1	0	2	15	0
22½	2½ ×	2½ ×	$\frac{5}{16}$	2 ×	2 ×	¼	⅞	¾	¾	3	2	21	3	5	0
25	3 ×	3 ×	⅜	2¼ ×	2¼ ×	¼	1	⅞	⅞	4	0	14	3	15	0



Trussed rafter Roof (with 1 Strut)

Spans 25 to 35 ft Steel principals 8 to 10 ft apart when carrying slates or tiles, and 12 to 14 ft apart when covering is corrugated iron

Span	T Rafters	T Struts	Flat Ties			Weight	Price
			Sides	Centre	Top		
ft	in in in	in in in	in in	in in	in in	cwt q lbs	£ s d
25	3 × 3 × 3/8	2 1/4 × 2 1/4 × 1/4	2 1/4 × 3/8	2 1/4 × 1/4	2 1/4 × 1/4	4 1 0	3 18 6
30	3 × 3 1/2 × 3/8	2 1/4 × 2 1/4 × 1/4	2 1/4 × 3/8	2 1/4 × 1/4	2 1/4 × 1/4	4 3 14	4 17 6
35	3 1/2 × 3 1/2 × 3/8	2 1/2 × 2 1/2 × 1/4	2 1/2 × 1/2	2 1/2 × 5/16	2 1/2 × 5/16	6 0 21	5 12 6



Trussed rafter Roof (with 2 Struts)

Spans 35 to 50 ft Steel principals 8 to 10 ft apart when carrying slates or tiles and 12 to 14 ft apart when covering is corrugated iron

Span.	T Rafters.	T Struts	Flat Ties				Weight.	Price
			Ends	Centre	Top	Sides		
ft	in in in	in in in	in in	in in	in in	in in	cwt. qrs lbs	£ s. d
35	3 × 3½ × ⅜	2½ × 2½ × $\frac{5}{16}$	3 × ⅝	3 × ⅜	2½ × ⅜	2 × ⅜	7 3 21	7 5 0
40	3½ × 3½ × ⅜	2½ × 2½ × [illegible] [illegible] × 2½ × [illegible]	3 × ⅝	3 × ⅜	2½ × ⅜	2½ × ⅜	9 0 0	8 5 0
45	3 × 3½ × ½	2½ × 2½ × [illegible] 3 × 3 × $\frac{5}{16}$	3½ × ½	3 × ½	3 × ⅜	2½ × ⅜	11 2 0	10 17 6
50	3½ × 3½ × ½	2½ × 3 × [illegible] 3 × 3 × [illegible] 3 × 2½ × ⅜	3½ × ½	3 × ½	3 × ⅜	2½ × ⅜	14 0 0	11 15 0

Light Roofs

For light cheap sheds and buildings, iron roofs can be erected at a cost of 1*s* to 1*s* 6*d* per ft sup of space covered including trusses, corrugated sheeting gutters, &c, or £5 to £8 per square

Materials.

(WITHOUT PROFIT)

		s	d
Allow for old wrot iron in exchange	per cwt	2	6
,, ,, cast iron if not burnt	,,	1	6
Ashes, coal, sifted	per bushel	0	3½
,, forge smith's	,,	0	4
Asbestos, ordinary millboard	per lb	1	0
,, rubber woven sheeting	,,	3	6
,, composition, No 1 quality, dry	per cwt	25	0
Borings, iron	,,	6	0
Breeze or coal dust	,,	1	0
Borax, lump	per lb	0	3
,, powdered	,,	0	3½
Cement iron	,,	0	2
,, red lead ground in oil	,,	0	3
Charcoal alder or willow	per bushel	1	6
Coal for forges, smith's	per ton	20	0
,, Newcastle, or other of equal quality	,,	24	0
Coke, gas, large	per bushel	0	8
Emery powder, fine or coarse	per lb	0	3
Gasket or gaskin, tarred, hemp	,,	0	5
Hoop iron galvanised	,,	0	3
[illegible]	,,	5	0
	,,	0	3
	,,	0	2½
	,,	0	3
	per gal.	0	9
,, neatsfoot	,,	4	0
,, olive or sweet	,,	5	0
,, Rangoon, for machinery	,,	2	0

MATERIALS—*continued.*

		s	d
Glass, or emery cloth	per quire	0	10
Glass paper, sand, or emery	"	0	10
Rivets, best wrought iron, 8 to 24 lbs per 1,000	per lb	0	4
" galvanised " " "	"	0	6
Roofing galv. corrugated W I sheets, No 20 S W G, with 3 in corrugations 1¼ in deep, 6 ft × 2 ft, s o	each	3	6
Ditto ditto, 7 ft × 2 ft, s o	"	4	0
Ditto ditto, 8 ft × 2 ft, s o	"	4	6
	per lb	0	4
washers	per doz	0	4
	per gross	12	0
girth, 20 B W G, in 6 ft lengths	per ft run	0	6
Sal ammoniac, white crystal	per lb.	0	7
Sulphur, for running	"	0	5
Swarf or iron filings	per cwt	4	0
Staples, round, 1¼ in long and under	per doz	0	2½
" " 1½ in to 2½ in long	"	0	4
Varnish, imperial, for ironwork	per gal	6	0
Waste, cotton	per lb	0	3
Wire, brass	"	1	0
" copper	"	1	3
" galvanised steel, 1 to 9 S W G	per cwt	13	0
" " " 10 to 17 S W G	"	17	0
" " " 18 to 19 S W G	"	21	0
" netting, galvanised iron 1 in to 1½ in mesh	per yd sup	0	5
Wick, cotton, for lamps	per lb	1	0
Yarn, spun or rope ½ to 1 in diam (22s per cwt)	"	0	3

WAGES

		s	d
Wages, smith s	per hour	0	10
" smith s labourer or assistant		0	7
" fitter s		0	10
" pattern maker s		0	10

ANALYSIS

The elementary differences between wrought iron, steel, and cast iron are —

Wrought iron contains little or no carbon not exceeding ¼ per cent
Steel contains a small percentage about 1 per cent
Cast iron contains a large percentage, about 4 per cent

Wrought iron articles are usually specified to be manufactured from iron equal in quality to best Staffordshire, and approved by the architect before fixing to be forged clean from the anvil, and neatly, soundly, and perfectly finished.

Steel is now generally substituted for rolled iron, especially in joists, on account of the greater strength embodied in

ble in every way Also, sly more economical to ost reliable method for uniform quality is the Siemens Martin open hearth acid process

Cast Iron is divided into "grey" and "white" The former is made from foundry pigs containing a large proportion of free carbon, the latter from forge pigs, which contain very little free carbon A mixture of grey and white is called "mottled" cast iron The usual description is that cast iron articles are to be of good soft grey iron from the second melting (and not run direct from the blast furnace), cast sound and clean, and subject to such tests as may be made by the architect or engineer

Coals of best quality for smith's work come from Wales the small stuff or screenings being used It is hard and anthracitic, but gives out great heat A sulphurous coal injures the quality of the iron

Sizes usually Manufactured

Bar Iron, round or square Bars under $\frac{3}{8}$ in diameter are classed as rods, and under $\frac{3}{16}$ in as wire —

Side or diameter	$\frac{3}{8}$ in to 4 in
Length	20 ft to 30 ft

Bar Iron, flat —

Section	1 in × $\frac{1}{4}$ in to 12 in × 1 in
Length	Up to 40 ft

Angle and T *Iron* can be obtained from 30 ft to 50 ft long, and up to 6 in × 6 in × $\frac{7}{8}$ in section

R S Beams are rolled up to 24 in deep and 40 ft long

less than $\frac{1}{16}$ in nerally obtained up to 4 ft wide, and 15 ft long, or 60 ft super, and sheets up to 3 ft wide and 8 ft long or 24 ft super

Steel—Table of the ordinary sizes to which steel can be rolled without extra charge —

Dimensions	Flat Bars	Round and Square	Angle	Tee	Channel and Joist
Length, feet	40	24	50	50	30
Width, inches	18	4	6 × 6	5 × 3	12
Thickness, inches	1	4	$\frac{7}{8}$	$\frac{3}{8}$	—

A great variety of other forms can also be obtained in iron and steel

Basis of Pricing

The basis of pricing smith's and founder's work is generally the weight, and when this is ascertained the comparative value of the labour can be adjusted and added. But in certain classes of articles the great difference in price is mainly a question of labour in relation to weight, the former being greater than the latter. It is essential to obtain prices for all ironwork direct from the founder or smith when there is any quantity, as the market fluctuates a good deal. The various qualities likewise cause great differences in cost. The price of good ordinary iron in England is about 1*d* per lb and the cost of the Farnley brand of best Yorkshire is 2*d* per lb. The latter, being tough and ductile, allows of greater facility in working and so proves cheaper in the end for superior work.

Although ironwork generally is billed at per weight, small articles are quoted by number, and such things as pipes and gutters by the foot run. Where patterns are plain they are often in stock, and are then included in the price quoted, which should be "delivered on site". Prices for London castings will be 1*s* to 1*s* 6*d* per cwt more than country castings. Rolled steel joists are billed at per cwt, but small

built up riveted girders for weight of rivets at the usual 4 in pitch, but only 2½ per cent for deep lattice girders

Average Market Prices

(Delivered in London)

April 1912	Per ton £	s	d		Per cwt. s	d		Per lb d
Rolled Steel Joists Belgian and German	5	15	0	=	5	9		0¾
Rolled Steel Joists English	7	10	0	=	7	6	=	0¾
Compound Girders ordinary sections	9	10	0		9	6		1
Wrought iron Girder plates	7	5	0	=	7	3	=	0¾
Steel Girder plates	8	5	0	=	8	3	=	1
Steel Compound Stanchions	11	10	0	=	11	6	=	1¼
Bar Iron good Staffordshire	8	10	0	=	8	6	=	1
Staffordshire Crown Bars	9	10	0		9	6	=	1
Staffordshire Marked Bars	11	0	0	=	11	0	=	1¼
Mild Steel Bars	9	10	0	=	9	6	=	1
Lowmoor flat round or square	20	0	0	=	20	0	=	2¼
Welsh	5	17	0	=	5	10	=	0¾
Boiler Plates iron Staffordshire	8	15	0	=	8	9	=	1

AVERAGE MARKET PRICES—*continued*

	Per ton £	s	d		Per cwt s	d		Per lb d
Angle iron 10s per ton extra	0	10	0	=	0	6	=	0¼
Tee iron 20s ditto	1	0	0	=	1	0	=	0¼
Galv corrugated sheet iron 18 to 24 gauge	15	0	0	=	15	0	=	1¼
Pig iron cold blast Lilleshall	5	15	0	=	5	9	=	0¼
hot blast	3	15	0	=	3	9	=	0¼
Cast iron columns	8	10	0	=	8	6	=	1
stanchions	8	10	0	=	8	6	=	1
sash weights	5	5	0	=	5	3	=	0¼
socket pipes 3 in	6	7	0	=	6	4	=	0¼
4 in to 6 in	6	5	0	=	6	3	=	0¼
7 in to 24 in	6	0	0	=	6	0	=	0¼
Coated with composition extra	0	5	0	=	0	3	=	0
Turned and bored joints extra	0	5	0	=	0	3	=	0

GENERAL NOTES ON COST

English rolled steel joists cost about £7 10s 0d per ton Belgian and German joists are cheaper or £5 15s per ton

Sawing ends square to required length while hot is included in the price A cutting margin of 1 in under or over specification is claimed as fulfilling this condition

Cutting to exact length —i e ½ in or ¼ in under or over specified length is charged 3s per ton extra

Cutting cold to dead length,' or perfectly true 5s to 7s 6d per ton extra Facing square is extra.

Cutting ends to bevel up to 12 in deep 1s 6d per end

Ends notched 1s 6d ditto

Stock lengths of R S beams are in even feet advancing 2 ft up to 40 ft Above 36 ft long 1s 6d per ton per foot ext h charged for as

ry within three weeks 5s per ton extra

For delivery from stock promptly, for quantities above 5 tons 10s per ton extra

For delivery from stock promptly, for quantities below 5 tons 15s per ton extra

Round holes in flanges 2d in webs 1d each

Oval holes in flanges, 3d in webs 2d each

Cold straightening when required is charged as an extra

In rolling manufacturers claim a margin of 2½ to 4 per cent

over or under the specified weights and no guarantee is given to roll sections without this allowance

Delivery from rolls i e direct from makers means a delay of 4 to 6 weeks but saving in cost is 20 per cent

Special quot
iron or mild st
are priced per

For wrought iron bars a margin of 6 in over any specified length to be allowed otherwise an extra is charged for cutting to exact lengths

Fixing of structural ironwork is about £1 per ton

Items of Work

The analysis of ironwork is simple and, being alike for

per cwt For conversion allow 6 hours of smith and assistant per cwt

		s	d
1 cwt wrought iron bar at £8 10s per ton		8	6
$\frac{1}{10}$ cwt coal for forges at 20s per ton		0	1
Labour converting 6 hours smith and assistant at 10d and 7d		8	6
Carriage and delivery loading and unloading		2	0
Fixing 1 hour bricklayer and labourer at 10½d and 7d		1	5½
		20	6½
Add 20 per cent profit &c		4	1½
Price per cwt	112)	24	8
Price per lb		0	2¾

For large quantities iron is billed at per cwt, but when in small amounts at per lb, the price will be relatively higher

Roof Irons — A smith and assistant will make per day a set of irons for a king post roof truss—viz, 2 heel straps, 1 set of crown irons 1 stirrup strap with bolts gibs, and keys &c, weighing 50 lbs total or 5¼ lbs per hour

Wrought Iron in Bars and Rails for Windows and Fixed —A better quality of iron would here be used at £9 10s per ton, or 9s 6d per cwt, and there would be more coals and labour

AVERAGE MARKET PRICES—*continued*

	Per ton £	s	d		Per cwt. s	d		Per l d
Angle iron 10*s* per ton extra	0	10	0	=	0	6	=	0½
Tee iron 20*s* ditto	1	0	0	=	1	0	=	0½
Galv corrugated sheet iron 18 to 24 gauge	15	0	0	=	15	0	=	1½
Pig iron cold blast Lilleshall	5	15	0	=	5	9	=	0¼
hot blast	3	15	0	=	3	9	=	0½
Cast iron columns	8	10	0	=	8	6	=	1
stanchions	8	10	0	=	8	6	=	1
sash weights	5	5	0	=	5	3	=	0½
socket pipes 3 in	6	7	0	=	6	4	=	0½
4 in to 6 in	6	5	0	=	6	3	=	0½
7 in to 24 in	6	0	0	=	6	0	=	0
Coated with composition extra	0	5	0	=	0	3	=	0
Turned and bored joints extra	0	5	0	=	0	3	=	0

GENERAL NOTES ON COST

English rolled steel joists cost about £7 10*s* 0*d* per ton Belgian and German joists are cheaper or £5 15*s* per ton

Sawing ends square to required length while hot is included in the price A cutting margin of 1 in under or over specification is claimed as fulfilling this condition

Cutting to exact length —*i e* ⅛ in or ¼ in under or over specified length is charged 3*s* per ton extra

Cutting cold to dead length or perfectly true 5*s* to 7*s* 6*d* per ton extra Facing square is extra

Cutting ends to bevel up to 12 in deep 1*s* 6*d* per end

Ends notched 1*s* 6*d* ditto

Stock lengths of R S beams are in even feet advancing 2 ft up to 40 ft Above 36 ft long 1*s* 6*d* per ton per foot extra Odd lengths are cut and the full length charged for as well as the cutting

For quantities under 5 tons and for delivery within three weeks 5*s* per ton extra

For delivery from stock promptly, for quantities above 5 tons 10*s* per ton extra

For delivery from stock promptly, for quantities below 5 tons 15*s* per ton extra

Round holes in flanges 2*d* in webs 1*d* each

Oval hol[illegible]

Cold straightening when required is charged as an extra

In rolling manufacturers claim a margin of 2½ to 4 percent

over or under the specified weights and no guarantee is given to roll sections without this allowance

Delivery from rolls &c, direct from makers means a delay of 4 to 6 weeks but saving in cost is 20 per cent

For wrought iron bars a margin of 6 in over any specified length to be allowed otherwise an extra is charged for cutting to exact lengths

Fixing of structural ironwork is about £1 per ton

ITEMS OF WORK

The analysis of ironwork is simple and being alike for

per cwt For conversion allow 6 hours of smith and assistant per cwt

		s	d
[illegible]		8	6
[illegible]		0	1
[illegible]	and [illegible]d	8	6
[illegible]		2	0
[illegible]		1	[illegible]½
		20	6½
Add 20 per cent profit &c		4	1½
Price per cwt	112)	24	8
Price per lb		0	2¾

For large quantities iron is billed at per cwt but when in small amounts at per lb the price will be relatively higher

Roof Irons —A smith and assistant will make per day a set of irons for a king post roof truss—viz 2 heel straps 1 set of crown irons 1 stirrup strap with bolts gibs and keys &c weighing 50 lbs total or 5¼ lbs per hour

Wrought Iron in Bars and Rails for Windows and Fixed—A better quality of iron would here be used at £9 10s per ton or 9s 6d per cwt and there would be more coals and labour

	s	d
1 cwt wrought iron bar at £9 10s per ton	9	6
1	0	2
7d	12	9
	?	0
	2	11
	27	4½
Add 20 per cent profit &c	5	5½
Price per cwt	11?)3?	10
Price per lb	0	3½

Pointing Ends to Bars —For pointing ends of ¾ in bars reckon ¼ hour smith and labourer to beat shape and file one and add fire and sharpening files, as well as profit

	s	d
½ hour smith and assistant at 10d and 7d	0	4¼
Fire and sharpening files	0	1
	0	5¼
Add profit &c	0	0¾
Price of each	0	6

Bolts Screw prepared with Heads Nuts and Washers and Fixed — These may be bought locally ready made, for 6d each if say ¾ in × 12 in in size By weight the cost would be 22s per cwt or 2¼d per lb for the iron supplied only, and prior to conversion Small ones are sold by the gross or dozen

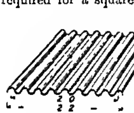
Bolt and Nut.

R. S Joist

Rolled Steel Joists Cut to Length and Fixed —The cost of these would be made up somewhat as follows For unloading getting in, hoisting and fixing by building contractor 2s 6d per cwt is a common charge

	s	d
1 cwt English R S joists at £7 10s 0d per ton	7	6
	0	2
	0	3
	0	9
	2	0
	0	3
	2	11
	13	10
Add 20 per cent profit &c	2	9
Price per cwt	16	7

Corrugated Iron Roofing —This is billed at per cwt , or more conveniently at per square fixed complete, including rivets or screws and washers For the area of roofs measure the surface and add one fourth for laps, or only one sixth if not corrugated The sheets are 6 to 9 ft long and 2 to 3 ft wide the usual gauges for roofs being Nos 20 or 22 An ordinary size is 8 ft × 2 ft with eight 3 in corrugations They should overlap about 6 in at top and bottom be bolted 9 in apart and double bolted at the cross joints A side intersection of one or two corrugations should be given which are 3 in to 5 in apart from centre to centre, and ¾ in to 1¼ in in depth From 2½ to 3½ lbs of bolts or rivets are required for a square of roofing One third added to the



Corrugated Sheet.

Galva ised Capp ng for Covering Ri l.e of Roof

Galvanised Screws for fixing Sheets to Wood

Bolts an l N ts for Jo nt ng Sheets togetl er

will give approxi
ets including laps
ht 1 to 1¼ ozs per
foot super for each side or 2 to 2½ ozs both sides

Galvanised corrugated sheets cost 12s to 16s per cwt from the manufacturer according to length and gauge Capping 6*d* per f r screws 3s 6*d* per gross and bolts and nuts 4s per gross

For fixing allow 3 hrs smith and mate per cwt and 3½ hrs if sheets are curved Hoisting per 10 ft say ⅛ hr ditto

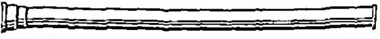
Iron Pipes —Iron pipes can be bought from any first class London firm as satisfactorily as from the manufacturers

rally specified to be wrought iron lap welded or butt welded galvanised tubing connected with screwed sockets of strong make, and capable of standing a hydraulic pressure of 400 ft

head of water and to have all requisite fittings such as bends elbows tees sockets &c, as may be required The whole to be put together with red lead cement and to be properly screwed Equal proportions of red and white-lead mixed with linseed oil make a good cement for joints in ironwork All connections to cisterns and boilers to be made with brass screw unions and fly nuts The fixing of pipes provides work for the fitter and his mate and the last named operative must not be overlooked

Discount off standard lists for wrought iron tubes and fittings f o b (plus 2½ per cent) —

Gas tubes	5 per cent.
Water tubes	– ½
Steam tubes	6– ½
Galvanised gas tubes	65
Galvanised water tubes	67½
Galvanised steam tubes	5 ½



Socket and Spigot Pipe

Flanged Pipe

Cast iron water pipes (9 ft lengths) should be specified to be cast vertically and to be proved to 600 ft head of water pressure (although 300 ft is sometimes deemed sufficient) the contractor to produce the manufacturer s certificate of such test For laying and jointing the contractor will have to provide the necessary firing tempered clay, yarn or pes ought to

cost would be worked out thus —A length of cast iron pipe 9 ft long and 9 in diam weighs about 4½ cwt — ½ cwt per ft run Cast-iron for pipes costs 6*s* per cwt + 3*d* for being coated with composition = 6*s* 3*d* per cwt total There fore 6*s* 3*d* × ½ cwt = 3*s* 1½*d* per ft run Add for carriage and delivery lead joints and labour laying

9 in Cast iron Socket and Spigot Pipe and Laying — Exclusive of digging If taken by the yard run a common measure the analysis would be —

		s	d
[illegible]		27	0
[illegible] loading		2	0
[illegible]		0	$1\frac{3}{4}$
[illegible]		2	$7\frac{1}{3}$
[illegible]		0	$0\frac{1}{2}$
$2\frac{1}{4}$ hrs smith and labourer, at 10*d* and 7*d*		3	$2\frac{1}{4}$
		35	0
Add 20 per cent profit, &c		7	0
Price per length of 3 yds	3)	42	0
Price per yard run		14	0

And 42*s* ÷ $4\frac{1}{2}$ cwt = 9*s* 4*d* per cwt Bends, tee pieces, &c , extra Add 3*d* per cwt or 5*d* per yd run, if coated with composition

Rust Joints —Iron cement, or rust-joint cement, for iron pipes, is made up (by weight) as follows —

Quick-setting 80 to 100 parts of iron borings or iron filings pounded fine, 1 powdered sal-ammoniac, and 2 powdered or flour sulphur. Mix thoroughly, and bring to a paste with water. This should be done one to two hours before required, and the paste must be used up the same day as it is made, or it will become prematurely hard.

Slow-setting 200 parts iron borings, 2 sal-ammoniac, 1 flour sulphur, all powdered and mixed as before This makes a better joint than the first "Swarf" is another name for iron borings or iron filings.

The joint space in socket is filled three fourths deep with caulked in yarn, and then $\frac{1}{4}$-in borings mixture This should not be pressed in too tightly, or too much, as it expands in setting and may split the pipe

3 *in Rainwater Pipe, and Fixed* —Cast iron down pipes are sold in 6 ft. lengths at per yard run for price, but are billed at per foot run. This sized pipe weighs 26 lbs per 6 ft length, equivalent to $4\frac{1}{3}$ lbs per foot run at 1*d* per lb. Oil red-lead cement for joints, one per length The analysis would be taken per 6 ft length

Rainwater or Down Pipe.

	s	d
6 ft of 3 in R W pipe, at 1*s* 3*d* per yard	2	6
2 pipe hooks (or ears) at 2*s* per dozen	0	4
2 plugs and 4 nails for last at 6*d* per dozen	0	2
Red lead ground in oil for joint	0	2
Labour fixing $\frac{1}{2}$ hour smith and labourer at 10*d* and 7*d*	0	8
	3	$10\frac{1}{2}$
Add 20 per cent profit &c	0	$9\frac{1}{2}$
	6) 4	8
Price per foot run	0	9

To prevent leakage and damp walls down pipes should be blocked off from the wall about 1 in

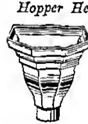
Swan neck

Add Extra to last for Swan neck, 6 in Projection and Fixed—As this is extra only for the cost of the bend over that of the price for straight the detail is slight Care must be taken however, to reckon the cost of the swan neck in length compared with that of a foot of straight piping In this instance a swan neck, with 6 in projection would have 3 in above and below in addition or 1 ft of total length

	s	d
Cost of 3 in swan neck 6 in projection	1	3
Deduct cost of 1 ft of straight piping	0	5
	0	10
1 red lead in oil joint	0	2
Extra labour in fixing ¼ hour smith at 10*d*	0	2½
	1	2½
Add 20 per cent profit &c	0	2½
Price of each extra only	1	5

Bends branches shoes &c, are similarly treated

Hopper Head, flat back to 3 in Pipe and Fixed—The design and cost vary, but a passable head costs as below Angle heads are more expensive

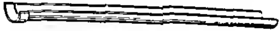


Hopper Head

	s	d
Hopper head flat back	1	6
Red lead joint	0	1
4 nails or screws	0	1
Fixing ¼ hour smith at 10*d*	0	2½
	1	10½
Add 20 per cent profit &c	0	4½
Price of each	2	3

5 in Half round Eaves Gutter, and Fixed—These are likewise sold in 6 ft lengths at per yard run for price and billed at per foot run The gutters have plain faucet joints put together with screw bolts and nuts and red lead, and supported per 6 ft length by two brackets or fastened to fascia with three 1¼ in stout screws including drilling and countersinking in iron for ditto The latter method how

ever, is for moulded gutters, with a vertical side. The analysis is also similar to rainwater pipes.



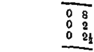
Eaves Gutter

	s	d
[illegible]	2	0
	0	6
	0	1
	0	1
	1	5
	4	1
Add 20 per cent profit, &c	0	10
	6)4	11
Price per foot run	0	10

Add Extra to last for Angles—Take an angle as 6 in each way, or 1 ft total length round. Then as swan necks —

	s	d
Cost of angle for 5 in H R gutter	1	0
Deduct cost of 1 ft of guttering	0	4
	0	8
2 bolts and 1 red lead joint	0	2
Extra fixing ¼ hour smith at 10*d*	0	2½
	1	0½
Add 20 per cent profit, &c	0	2½
Price of each extra only	1	3

Add Extra for Nozzles or Outlets — The nozzle is cast on to a small piece of guttering 1 ft long Therefore—



	s	d
Cost of nozzle length of 5 in guttering	1	0
Deduct cost of 1 ft of guttering	0	4
	0	8
2 bolts and 1 red lead joint	0	2
Extra fixing ¼ hour smith at 10*d*	0	2½
	1	0½
Add 20 per cent profit &c	0	2½
Price of each extra only	1	3

Caulking Tank.—It takes 2 men 4 days of 10 hours = 80 hours to put together with bolts and nuts and caulk a 5,000 gals. cast iron octagonal tank supplied by Messrs. Douglass, Blaydon-on-Tyne. Each tank comprises 9 bottom plates and 16 side plates in two heights of $\frac{5}{8}$ in. metal, the total standing 7 ft. high and 12 ft. across. The weight of the tank complete is 12,050 lbs., and it is supported on a brick or concrete base. To form the rust joints 4 cwt. of swarf (iron filings), sal ammoniac and sulphur are required, also 160 lbs. of screwed bolts and nuts. For flanges allow 1 in. width for every 1 ft. width of plates.

Painting.—When metal is painted before it leaves the manufacturer's premises a rough cost is 2*s*. 6*d*. per ton for giving average cast iron work 1 coat red oxide, but for open wrought iron work, such as roof trusses, up to 5*s*. per ton. In closer estimating 1 gal. paint will cover 90 y.s. on iron and 70 y.s. on wood 1st coat, or 2½*d*. to 4*d*. per y.s. for materials and labour, if done by a labourer and without profit. Materials go further in subsequent coats.

Packing.—Charge 2½ per cent. of maker's price on light articles collected and packed in boxes and 1 per cent. on cranes and roofs. Packing unnecessary for girders and joists.

Carriage.—1*s*. 6*d*. per ton of load will repay firm for their own horse and cartage within the mile limit.

For rail transit 1*d*. per ton per mile plus 5*s*. per ton for collection and delivery. If goods travel over more than one company's lines this approximation is not so safe.

CHAPTER XVI.—COPPERSMITH.

MEMORANDA

Gauges of Copper and Brass
(Birmingham Wire Gauge)

Weight per Foot Super

B W G	Copper	Brass	B W G	Copper	Brass
No	lbs	lbs	No	lbs	lbs
1	14 50	13 75	16	2 90	2 75
2	13 90	13 10	17	2 62	2 40
3	12 75	12 10	18	2 15	2 04
4	11 60	11 00	19	1 97	1 87
5	10 10	9 61	20	1 78	1 69
6	9 40	8 93	21	1 62	1 54
7	8 70	8 25	22	1 45	1 37
8	7 90	7 54	23	1 30	1 23
9	7 20	6 86	24	1 16	1 10
10	6 50	6 18	25	1 04	99
11	5 80	5 50	26	92	89
12	5 08	4 81	27	83	79
13	4 34	4 12	28	74	70
14	3 60	3 43	29	64	61
15	3 27	3 10	30	58	55

Expansion

The expansion of copper per 100 ft in length for an increase of 100° Fah is 1 28 in or about 1¼ in Melting point 1 950 Fah

Cube Weights

Brass ordinary = 519 lbs per ft cube
Copper cast = 537
sheet = 550
wrought = 555
Gun metal = 528

Solders

For copper —2 parts zinc to 3 to 6 parts copper
For brass 1 part zinc to 1 part copper

Copper and Brass—Weight per Foot Super

Thickness	Copper	Brass.	Thickness	Copper	Brass
in	lbs	lbs	in	lbs	lbs
1/16	2 89	2 73	9/16	26 02	24 61
1/8	5 78	5 47	5/8	28 91	27 34
3/16	8 67	8 20	11/16	31 80	30 08
1/4	11 56	10 94	3/4	34 69	32 81
5/16	14 45	13 67	13/16	37 58	35 55
3/8	17 34	16 41	7/8	40 47	38 28
7/16	20 23	19 14	15/16	43 36	41 02
1/2	23 13	21 88	1	46 25	43 75

Copper Nails

Description	1 in	1¼ in	1½ in	1¾ in	2 in
Copper nails	No per lb 400	No per lb 250	No per lb 160	No per lb. 112	No per lb 85

Copper Rods—Weight per Foot Run

Diameter or Side	Round	Square	Diameter or Side	Round	Square
in	lbs	lbs	in	lbs	lbs
1/8	047	060	1½	6 811	8 672
3/16	106	135	1 9/16	7 890	9 410
1/4	189	241	1⅝	7 993	10 177
5/16	296	376	1¾	9 270	11 803
3/8	426	542	1⅞	10 642	13 550
7/16	579	738	2	12 108	15 417
1/2	757	964	2⅛	13 668	17 404
9/16	958	1 219	2¼	15 325	19 512
5/8	1 182	1 506	2⅜	17·075	21·740
11/16	1 431	1 822	2½	18 916	24·089
3/4	1 703	2 168	2⅝	20 856	26 558
13/16	1·998	2 544	2¾	22 891	29 146
7/8	2 318	2 951	2⅞	25 019	31 856
15/16	2 661	3 387	3	27 244	34 688
1	3 027	3 854	3⅛	29 599	37 688
1 1/16	3 417	4 351	3¼	31 972	40 710
1⅛	3 831	4 878	3⅜	34 482	43·901
1 3/16	4 269	5 435	3½	37 081	47 214
1¼	4 730	6 022	3⅝	39 777	50 646
1 5/16	5 214	6 634	3¾	42 568	54 199
1⅜	5 723	7 287	3⅞	45 550	57 873
1 7/16	6 255	7 964	4	48 433	61 676

Copper Pipes —Weight Per Foot Run

Bore	Thickness of Metal in Parts of an Inch.							
	$\frac{1}{16}$	$\frac{1}{8}$	$\frac{3}{16}$	$\frac{1}{4}$	$\frac{5}{16}$	$\frac{3}{8}$	$\frac{7}{16}$	$\frac{1}{2}$
in	lbs	lbs	lbs	lbs	lbs	lbs	lbs	lbs
$\frac{1}{4}$	24	57	99	1 51	2 13	2 84	3 64	4 54
$\frac{1}{2}$	43	95	1 56	2 27	3 08	3 97	4 97	6 05
$\frac{3}{4}$	62	1 32	2 13	3 03	4 02	5 11	6 29	7 57
1	80	1 70	2 70	3 78	4 97	6 24	7 62	9 08
$1\frac{1}{4}$	99	2 08	3 26	4 54	5 91	7 38	8 94	10 60
$1\frac{1}{2}$	1 18	2 46	3 83	5 30	6 66	8 51	10·26	12 11
$1\frac{3}{4}$	1 37	2 84	4 40	6 06	7 81	9 65	11 59	13 62
2	1 56	3 22	4 97	6 81	8 75	10 78	12 91	15 14
$2\frac{1}{4}$	1 75	3 59	5 53	7 57	9 69	11 92	14 23	16 65
$2\frac{1}{2}$	1 94	3 98	6 10	8 33	10 64	13 07	15 56	18 17
$2\frac{3}{4}$	2 13	4 35	6 67	9 08	12 53	14 19	16 89	19 68
3	2 32	4 73	7 24	9 74	18 59	15 33	18 21	21 19

Pipes are invariably measured by their internal diameters

Down Pipes and Gutters

4 in copper down pipes — 2 lbs per ft run
6 in copper eaves gutters = $1\frac{1}{2}$ lbs

For copper down pipes eaves gutters hopper heads &c use copper of Nos 19 to 25 gauge or 2 lbs to 1 lb per ft super

Fixing Copper Pipes

Copper pipes with brazed joints hooks, &c, and fixed complete —

Per 10 ft length	[illegible] in	[illegible] in	[illegible] in	[illegible] in
Pipe ft run	10·00	10·00	10 00	10·00
Hooks hundred	·05	·05	·05	·05
Brazing solder ozs	2·00	2 50	2 75	2 75
Coals cwt	·04	·04	·04	·04
Fitter and labourer hrs	1 50	1·65	1 80	1·90
10)				
Per ft run				

Brass Pipes.—Weight per Foot Run.

Bore	Thickness of Metal in Parts of an Inch							
	$\frac{1}{16}$	$\frac{1}{8}$	$\frac{3}{16}$	$\frac{1}{4}$	$\frac{5}{16}$	$\frac{3}{8}$	$\frac{7}{16}$	$\frac{1}{2}$
in	lbs	lbs	lbs	lbs	lbs	lbs	lbs	lbs
¼	·23	·54	·91	1·43	2·01	2·68	3·45	4·30
½	·40	·90	1·48	2·15	2·91	3·76	4·70	5·73
¾	·58	1·25	2·01	2·86	3·80	4·83	5·95	7·18
1	·76	1·61	2·55	3·58	4·70	5·93	7·25	8·59
1¼	·94	1·97	3·09	4·32	5·64	6·98	9·46	10·02
1½	1·12	2·33	3·67	5·01	6·49	8·05	9·71	11·45
1¾	1·33	2·69	4·14	5·71	7·36	9·11	10·94	12·85
2	1·48	3·04	4·70	6·44	8·23	10·20	12·22	14·32
2¼	1·65	3·40	5·24	7·16	9·17	11·28	13·47	15·75
2½	1·83	3·76	5·77	7·87	10·07	12·35	14·72	17·18
2¾	2·01	4·12	6·31	8·59	10·96	13·42	15·97	18·81
3	2·19	4·47	6·85	9·31	11·66	14·70	17·23	20·04

Brass Tubes.—Weight per Foot Run.

External Diameter	Thickness of Metal, B W G				
	10	11	12	13	14
in	lbs	lbs	lbs	lbs	lbs
⅝	·756	·696	·646	·579	·517
¾	·948	·869	·803	·715	·636
⅞	1·141	1·041	·960	·852	·755
1	1·334	1·214	1·110	·988	·875
1⅛	1·506	1·386	1·273	1·125	·991
1¼	1·719	1·558	1·429	1·261	1·113
1⅜	1·911	1·731	1·586	1·397	1·233
1½	1·104	1·903	1·742	1·534	1·352
1⅝	2·296	2·076	1·899	1·670	1·471
1¾	2·489	2·248	2·056	1·807	1·590
1⅞	2·681	2·420	2·212	1·943	1·710
2	2·874	2·593	2·369	2·080	1·829
2¼	3·259	2·938	2·682	2·353	2·067
2½	3·644	3·282	2·995	2·626	2·306
2¾	4·029	3·667	3·308	2·899	2·544
3	4·414	3·972	3·622	3·172	2·783

Copper Lightning Conductors

Rods

	Per ft run		Per ft run
⅜ in diam	6.88 ozs	⅝ in diam	19.00 ozs
½ in	12.16 ozs	¾ in	27.00 ozs

Ropes

⅜ in diam	4.60 ozs	$\frac{9}{16}$ in diam	11.60 ozs
½ in	10.06 ozs	⅝ in	15.30 ozs

Tapes

⅝ in × $\frac{1}{12}$ in	3.20 ozs	1¼ in × ⅛ in	9.55 ozs
¾ in × ⅛ in	5.73 ozs	1½ in × ⅛ in	11.46 ozs
1 in × $\frac{1}{16}$ in	3.84 ozs	1½ in × $\frac{3}{16}$ in	17.28 ozs
1 in × ⅛ in	7.64 ozs	2 in × ⅛ in	15.28 ozs

These tapes should have a conductivity of 90 to 98 per cent of that of pure copper and are manufactured in lengths of 300 ft and upwards

Gunmetal holdfasts for 1 in tapes = 1.60 ozs each
1½ in = 1.92 ozs

Copper earth plates 4 ft × 2 ft × $\frac{1}{16}$ in
3 ft × 3 ft × $\frac{1}{16}$ in
2 ft × 2 ft × $\frac{1}{16}$ in

Washing Coppers

Dimensions are taken diagonally from the top of rim to the bottom edge

Size	Capacity	Weight	Size	Capacity	Weight
in	gals	lbs	in	gals	lbs
9¾	1	1½	27¼	23	34½
12¼	2	3	27½	24	36
14	3	4½	27¾	25	37½
15½	4	6	28	26	39
16½	5	7½	28½	27	40½
17½	6	9	29	28	42
18½	7	10½	29½	29	43½
19½	8	12	30	30	45
20	9	13½	31	33	50
21	10	15	32	36	54
21½	11	16½	33	40	60
22	12	18	34	43	64½
22½	13	19½	35	49	72
23	14	20½	35½	50	75½
24	15	22½	36	55	79½
24½	16	24	37	59	87
25	17	25½	38	63	94½
25½	18	27	39	67	100½
26	19	28½	40	71	106½
26½	20	30	45	104	156
26¾	21	31½	50	146	219
27	22	33	55	209	312

Cocks for Coppers

Capacity of Copper	Bore of Cock	Weight of Cock	Capacity of Copper	Bore of Cock	Weight of Cock
gals	in	lbs	gals	in	lbs
30	1¼	7	200	2¾	30
50	1¾	8	260	3	34
80	2	12	340	3¼	44
120	2¼	19	420	3½	56
150	2½	26	430	3¾	70

Copper Cylinders.

Sizes and capacity vary with makers Tested up to 40 lbs pressure

Capacity	Diameter and Height	Weight
gals	in in	lbs
19	15 × 30	39
25	16 × 33	44
30	15 × 45	55
35	17 × 42	61
40	18 × 39	63
45	18 × 42	67
50	23 × 33	91
55	20 × 48	98
61	21 × 48	101
66	22 × 48	112
70	23 × 48	126
76	21 × 48	146

PRICES

Sheet Copper

		s	*d*
12 ozs per ft sup sheet copper and laying to flats and gutters *including laps rolls seams nails* welts ties and labour fixing	per ft sup	1	5
16 ozs ditto ditto ditto		1	8
18 ozs ditto ditto ditto		1	10
20 ozs ditto ditto ditto		2	0
For every oz in weight above or under add or deduct		0	2
For cupolas domes or verandahs add		0	3
Taking up redressing and relaying sheet copper to roofs any weight including solder &c		0	6
Welted edge or seam ¼ in wide labour only	*per ft run*	0	3
Close copper nailing ½ to 1 in apart		0	4

Copper by Weight

per lb

- Copper down pipes 4 in diam and weighing 2 lbs per ft run or any other size
- Copper hopper heads and shoes
- Copper gutters 6 in diam and weighing 1½ lbs per ft run including brackets outlets &c
- Copper holdfasts staples gratings &c
- Copper in screwed work as bolts and nuts hooks rings &c
- Copper boilers riveted complete
- Washing coppers riveted
- seamed

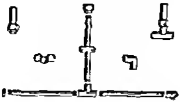
Copper Pipes

2 in copper pipes	1½ lbs per ft run supplied only	
2½ in	1¾ lbs	
3 in	2¼ lbs	
3½ in	2¾ lbs	
4 in	3 lbs	
4½ in	3½ lbs	
5 in	4¼ lbs	
Joints to ditto for 2 in pipes		
2½ in		
3 in		
3½ in		
4 in		
4½ in		
5 in		
Copper speaking tube supplied only	per ft run	

Down Pipes and Gutters

2½ in coppered wrought pipes with tacks &c supplied only per ft r		
3 in		
3½ in		
4 in		
[illegible]		2
8 [illegible]		2
10 in		2
12 in		2
[illegible]		2
[illegible]		0 2
[illegible]	each	15 0
		1 3

Sparge Pipes &c



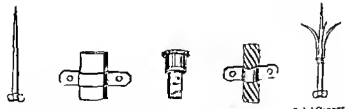
Sparge Pipes.

		½ in	¾-in	1 in	1¼ in	1½ in
		s d	s d	s d	s d	s d
Plain copper pipes s o (list price)	per ft	0 9	1 1	1 5	1 9	2 0
Copper sparge pipes with weeping holes s o		1 3	1 6	2 0	—	—
Copper clips for pipes s o	per doz	2 6	3 6	5 0	6 0	7 0
Copper caps for pipes s o	each	0 6	0 8	0 9	—	—
Elbows screwed both ends s o		1 3	1 0	2 3	2 9	3 6
Tee pieces screwed all ends s o		2 0	2 6	2 9	3 3	4 0

Brass Tubes

		s d
¼ in	Brass tubing or copper pipes brazed supplied only per ft run	0 4
½ in		0 7
¾ in		0 11
1 in		1 2
1½ in		1 9
2 in		2 6
Brass tubing supplied only by weight	per lb	1 3

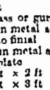
Copper Lightning Conductors



Plain Solid Copper Point. Solid Copper Band Conductor and Clip Coupling for Tape to Rope or Tube Copper Wire Rope Conductor and Clip Solid Copper Crowfoot Point.

		s d
⅝ in × 1/12 in	copper tape continuous and all fittings s o per ft run	0 7
¾ in × ⅛ in		0 9
1 in × ⅛ in		1 0
1¼ in × ⅛ in		1 3
1½ in × ⅛ in		1 6
2 in × ⅛ in		1 10

Copper Lightning Conductors—*continued*		s	d
Fixing foregoing to houses and mansions	per ft run	0	4
to steeples and lofty chimneys		0	6
⅜ in copper rope continuous and all fittings s o		0	10
$\frac{7}{16}$ in		1	0
½ in		1	3
$\frac{9}{16}$ in		1	6
⅝ in		1	9
¾ in		2	0
Fixing foregoing to houses and mansions		0	6
to steeples and lofty chimneys		0	9
⅝ in copper tubes for elevation rods supplied only		1	9
¾ in		2	3
1 in		2	9
	per doz	3	6
		3	9
		1	0
	each	3	0
		1	9
3 ft × ¾ in plain solid copper point s o		11	0
Crowsfoot point for ¾ in × ⅛ in copper tape s o		10	0
1 in × ⅛ in		13	6
1¼ in × ⅛ in		15	0
⅝ in copper rope s o		10	0
¾ in		12	6
⅞ in		15	0
		30	0
		40	0
		21	0
		23	0
5 ft		25	0
Brass or gun metal saddle for apex or ridge of roof s o		12	6
Gun metal screwed coupling for connecting tape or rod to finial		2	6
Gun metal attachment for joining tape or rope to earth plate		1	6
4 ft × 2 ft × $\frac{1}{16}$ in copper earth plates s o		45	0
3 ft × 3 ft × $\frac{1}{16}$ in		54	0
2 ft × 2 ft × $\frac{1}{16}$ in		24	0
Galvanometer with dry battery for testing conductors		40	0
Copper in copper tape lightning conductors s o	per lb	1	0
1 in and 1¼ in gunmetal holdfasts for ditto		1	2
Copper nails for fixing conductors &c s o		1	5



Cylinder

Copper Cylinders		£	s	d
15 gals copper circulating cylinders s o	each	2	10	0
20 gals		3	0	0
25 gals		3	10	0
30 gals		4	0	0
35 gals		4	10	0
40 gals	"	5	0	0

MATERIALS

(WITHOUT PROFIT)

Item	Weight per ft sup	Weight per sheet	Unit	£	s	d
Brass chains 1 to 3 lbs per yard &c			per lb		1	6
Brass rod solid or hollow					1	0
Brass thin sheet					1	0
Coal for forges smith's			per ton		20	0
Coal Newcastle or other of equal quality					24	0
Coke gas large			per bushel		0	8
Copper British cake and ingot at £69 per ton delivered			per lb		0	8½
sheathing and rods at £80 per ton ditto					0	10
bolt or bar cut to length ditto					1	0
in thin sheets cut to size ditto					1	0
Copper sheets 4 ft × 2 ft common plates—						
No 20 B W G	1·78 lbs per ft sup	or 14¼ lbs per sheet	per cwt	£4	18	0
22	1·45 lbs	11½ lbs		4	17	0
24	1·16 lbs	9¼ lbs		4	16	0
26	·92 lbs	7⅜ lbs		5	5	0
28	·74 lbs	6 lbs		5	10	0
30	·58 lbs	4⅝ lbs		6	0	0
If cut to dimensions add				0	10	0
Nails copper cast			per lb	0	1	2
¾ in nails copper wrought				0	1	6
1 in				0	1	3
2 in				0	1	1
Rivets copper				0	1	5
Spelter brass yellow				0	1	0
copper yellow				0	1	0
zinc				0	0	6
Wire brass				0	1	0
copper				0	1	8

WAGES

Item	Unit	s	d
Wages coppersmith's	per hour	0	10
coppersmith's labourer		0	7

ANALYSIS

Copper in roof covering is measured by the foot super including allowances for seams welts caps &c and is nearly always sub let The most useful size of sheets for the builder is 4 ft × 2 ft termed common plates These are made of different gauges and weights as shown in the table under Memoranda

16 ozs Sheet Copper and Laying to Flats and Gutters— This weight is practically equivalent to No 25 B W G gauge Of late copper has risen in price and may be taken at about £80 per ton for sheathing (April 1912) British ingots and cakes are much less This equals say 9*d* per lb from merchant And 16 ozs = 1 lb – 9*d* per

foot super, supplied only Add delivery, waste in cutting, nails and solder, labour laying, and profit

	s	d
16 ozs, or 1 lb sheet copper, per ft sup	0	9
C [illegible]	0	1
[illegible]	0	1
[illegible]	0	1
[illegible]	0	4½
	1	4½
Add 20 per cent profit &c	0	3½
Price per foot super	1	8

½ in *Copper Pipes and Fixed* —These are measured by the foot run but cannot be accurately analysed in such a short length A fair distance of 10 ft must therefore be taken and the materials and labour for such divided by 10 to arrive at the net unit price For these data see information on Fixing Copper Pipes in Memoranda and detailed below for a 10 ft length

	s	d
½ in copper pipe 10 ft at 7*d*	5	10
5 brass hooks at 3*s* 6*d* per dozen	1	5½
2½ ozs brazing solder at 1*s* per lb	0	2
01 cwt coals at 20*s* per ton	0	0½
1 65 hours coppersmith and mate at 10*d* and 7*d*	2	4
	9	10
Add 20 per cent profit &c.	2	0
	10)11	10
Price per foot run	1	2

CHAPTER XVII.—BELLHANGER.

MEMORANDA

Bell Metal

Small bells are composed of	1 part tin and	5 parts copper
Large bells	1	4
Church bells	1	$3\frac{1}{2}$
House bells	1	3 or 4

Weight of Bells

Size	Note	Approximate weight.		
		Cwt	qrs.	lbs.
6 in. diameter	—	—	—	$4\frac{1}{2}$
7	—	—	—	$7\frac{1}{4}$
8	—	—	—	9
9	—	—	—	15
10	—	—	—	21
12	—	—	1	16
14	—	—	2	12
16	C	1	0	17
20	G	1	3	0
25	E Flat	3	2	0
30	C	5	3	0
35	B	8	0	0
40	G	12	0	0
45	F	16	0	0
50	E Flat	23	0	0
55	D	29	0	0
60	C	36	0	0

Common house bells worked by wires and cranks weigh about 14 ozs
Tubular bells weigh from 50 lbs to 900 lbs each

General Proportions of Bells

Diameter at mouth	10
Diameter at shoulder	5
Height from mouth to shoulder	8
Thickness of part struck	$\frac{1}{15}$ diam

The part where clapper strikes is called the sound bow or brim.

Galvanised Iron Bell Tubing

	in	in	in	in	in	
Diam	$\frac{3}{8}$	$\frac{1}{2}$	$\frac{9}{16}$	$\frac{5}{8}$	$\frac{3}{4}$	in 6-ft lengths
No	22	22	22	22	22	wire gauge

Electric Bells

Three types single stroke, trembling and continuous

Leclanché cells are suitable where the current is intermittent They are charged with a solution of sal ammoniac —$2\frac{1}{2}$ ozs sal ammoniac to 1 pint of water Batteries should be $\frac{3}{4}$ full and stand in a cool place Dry cells also used

A Daniell cell = 1 volt A Leclanche cell = $1\frac{1}{2}$ volts

Allow 3 or 4 quart cells for 12 to 20 pushes

Pressure for bell currents 3 to 10 volts

Electric Units

Name	Unit
Resistance	Ohm
Current	Ampère
Quantity	Coulomb
Pressure	Volt
Capacity	Farad
Power	Watt
Energy or work	Joule

Electric Wires

H C tinned copper wires insulated with vulcanised indiarubber and taped or cotton covered and paraffined Twin wire forbidden

22 S W G	2 diameter in m/m	weighs 23 33 lbs per mile
20	2 2	33 33 lbs
18	2 5	53 33 lbs

Electric Currents

A continuous or direct " current flows continuously one way
An alternating current flows alternately in opposite directions
An intermittent current flows and stops frequently
A current can be converted or transformed as required

PRICES

Church Bells

		£	£
Hung complete in frames fittings and fixing in peals of 3 4 5 6 or 8 bells up to 3 5 12 16 and 18 cwt for tenor	per set	100 to	800
Ditto specially cast when priced by weight	per cwt	5	7

Spring and Crank Bells

		s	d
Bells hung complete *with* secret zinc tubing and best mounted cranks copper wire check springs staples ȝ tho bell spring			
on same floor	per pull	12	0
one story	,	14	0
two stories		16	0
three stories		18	0
		4	0
ubing finding all the labour and copper wire check springs and staples but exclusive of cranks bells springs carriages and pulls on same floor		4	6
Ditto d tto one story		6	0
D tto d tto two stories		7	6
Ditto ditto three stories		9	0
Ditto for extra pulls on the same bell		2	0

Fittings

		s	d
Be [illegible]	per lb	2	3
[illegible]		1	6
[illegible]		1	5
3 in	each	1	0
[illegible] 3½ in		1	5
1 3 4 in		2	4
Add f with springs carr ages and pendulum		2	6
14 oz bell ith spring and T plate back spring carr age		6	0
Bell carriage wrought		2	9
Bell levers brass surbase		4	6
with box		7	0
Bell levers iron scroll and rods for area railing		8	0
various patterns in bronzed brass from		10	0
pol shed		12	0
Bell pulls 3 in brass knob with plate suppl ed only		2	0
add if fixed		0	8
w th sunk plate suppl ed only		4	6
add if fixed		1	0
brass outside sunk handle supplied only		2	0
add if fixed		0	10
4 in brass sl de or bolt supplied only		1	10
add if fixed		0	6
bronzed outside sunk handle supplied only		5	6
add if fixed		1	3
lever with white or black knob supplied only		4	6
add if fixed		0	9
refixed and tighten ng wires		1	6
Bell springs single scroll small		0	3
double		0	5½
Check springs coppered steel wire 5 to 7 in long		0	2
Cranks wheel and chain		1	3

Fittings—*continued*

		s	d
	each	0	4
		0	3
		2	3
add if fixed		0	7
mortise single double or chain supplied only		1	4
mortise single double or chain add if fixed		0	6
mounted pillar or T plate supplied only		0	10
add if fixed		0	6
spring rose purchase supplied only		1	6
add if fixed		0	6
Driving cranks 1 suite 2 fly		0	6
Leader		1	0
Pillar		1	2
Fly only		0	2½
Gongs for prisons average		50	0
Fixing ditto in corridor		6	0
Fixing pull in cell		3	6
Pendulums with springs		0	10
Wheel and chain flat mounted		1	1
mortise mounted		1	1
pillar single		1	7
double		2	0
Brass rings for worsted line pulls		0	4
[illegible] in worsted line green or red for bell pulls	per yd run	0	2½
Add if fixed		0	1
[illegible] in stout zinc tubing for bell wire	per ft run	0	2
Add if fixed		0	0½

Materials

(WITHOUT PROFIT)

		s	d
Nails countersunk brass headed	per doz	0	6
copper cast	per lb	1	2
wrought		1	3
zinc		0	6
Spelter brass yellow		1	0
copper		1	0
zinc		0	6
Staples coppered steel round on square top [illegible] to [illegible] in		0	9
[illegible] [illegible] in		0	7
tinned steel [illegible] [illegible] in		0	10
[illegible] [illegible] in		0	8
bell galvanised wire up to 1 in	per doz	0	3
coppered wire [illegible] in to 1 in	per gross 3*d* to 6*d*		
tinned wire	5*d* to [illegible]*d*		
Tubing brass	per lb	1	9
" compo		0	6
" copper		1	4
" zinc		0	5
Wire brass		1	0
copper		1	9
galvanised steel 1 [illegible] [illegible] W G	per cwt	13	0
" 10 to 1[illegible]		1[illegible]	0
18 to 1[illegible]		21	0

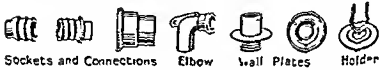
Wages

		s.	d.
Wages bellhangers	per hour	0	9½
bellhanger's labourers		0	7
electrical wiremen's		0	9½
electrical labourers		0	7

Tubular Bells

Single bells	£15 upward
Peal of bells	£150 to £800
Weight of bells	50 lbs. to 200 lbs.

Speaking Tubes



Tubes and Fittings.		½ in. s.	d.	⅝ in. s.	d.	¾ in. s.	d.	1 in. s.	d.
Composition speaking tube	per ft. run	0	4	0	4½	0	5	0	5½
Copper		1	0	1	2	1	4	1	6
Zinc		0	3	0	4	0	5	0	6
Flexible vulcanised rubber tubing mohair and silk		1	5	1	9	2	[illegible]	2	6
Ditto ditto silk braided		3	10	4	6	5	3	6	0
Ditto ditto worsted braided		1	3	1	6	1	9	2	0
Bends or circular elbows for copper tubing	each	2	3	[illegible]	6	[illegible]	9	3	0
Ditto ditto zinc tubing		0	6	0	8	0	10	1	0
Clips, copper, for fixing tubing		0	1	0	1½	0	1½	0	2
zinc		0	0½	0	0½	0	1	0	1
Connecting screws for tubing		1	0	1	1	1	2	1	3
Brass unions for connecting metal tubing to flexible tubing		1	2	1	3	1	4	1	5
Brass tube connection between flexible tubing and mouthpiece	"	0	6	0	7	0	8	0	9
Mouthpiece and whistle round, with male or female screwed end to take tubing, cocus wood		2	0	2	3	2	6	2	[illegible]
Ditto ditto ebony or box		[illegible]	3	2	6	2	9	3	0
Ditto ditto ivory		[illegible]	0	[illegible]	0	9	0	10	0
Ditto ditto brass		4	0	4	6	5	0	5	6
With red ivory indicators extra		0	8	0	[illegible]	0	8	0	[illegible]
Whalebone ditto		0	[illegible]	0	2	0	2	0	2
Brass holder with plate for terminals		0	5	0	6	0	7	0	[illegible]

Fixing extra on foregoing. ¾ in. compo tubing weighs 3½ lbs. per yd.

Electric Bells

(List Prices)


Electric Bell.


Leclanché Cell


Porous Pot.


Zinc Rod


Carbon Plate.

Bells

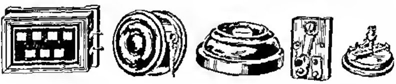
		s	d
Electric trembling bells medium quality 2½ in gong teak base	each	3	3
2¾ in		3	9
3 in		5	3
3½ in		6	3
4 in		7	9
6 in		18	6
Fixing electric trembling bells complete any size including connecting wires &c		1	0

Batteries

		s	d
E C C dry cell No 1 size 3½ diam × 8 in high	each	3	0
O F C 1 R 3½ diam × 7½ in high		2	9
Leclanché cells cell complete 2 pint (quart)		1	0
3		1	10½
sealed cells 2 pint (quart)		1	6
3		2	4½
porous pots charged 2 pint (quart)		0	6½
3		0	11
zinc rods 2 pint (quart)		0	3
3		0	4
glass jars 2 pint (quart)	,,	0	4
3	,,	0	6
sal ammoniac 4 ozs for 2 pint (quart)		0	2
6 ozs ,, 3		0	3
carbon plates 2 pint (quart)		0	2½
3		0	4
sal ammoniac white crystal or powdered per lb		0	7
Fixing Leclanché cells complete with connecting wires	each	0	9
porous pots	,,	0	6
zinc rods	,,	0	3
glass jars	,,	0	3

Cords

		s	d
Flexible silk cord for pear pushes &c double conductor twisted in any colour 2 strand medium	per doz yds	1	6
Ditto ditto 3 strand medium		2	6



Ind cator Bedroom Pull Wood Push Lever Switch Plug Switch

Indicators

		s	d
Indicators with self replacing pendulum superior quality polished teak ca es glass fronts ordinary swing size for 2 Numbers at per No	each	4	0
Ditto ditto 3		3	8
Ditto ditto 4		3	3
Ditto ditto 5		2	9
Ditto ditto 6 up to 40		2	6
Ind cators with mechanical replacement ordinary quality polished teak cases glass fronts size for 2 to 4 Numbers at per No		2	6
Ditto ditto 5 up to 30		2	0
3 in bell attached extra		4	0
Fixing indicators for 2 to 6 Numbers with connections		1	6
6 12		2	0

Pulls

		s	d
Pulls bedroom in polished brass 2½ in	each	2	6
in cocus or ebony 2½ in		2	0
n satinwood or walnut 2½ in		1	8
outdoor bronzed sunk 4 in		6	6
Fixing pulls and connecting to wires		1	0

Pushes

		s	d
2½ in brass pushes ord nary quality	each	1	1
3 in	,	1	2
2½ in with ebonite backs		1	8
3 in		2	0
2½ in china pushes all china plain with gold lines		1	0
3 in		1	2
2½ in with hardwood backs		0	9
3 in		0	10
2½ in wood pushes best quality in cherry oak walnut &c		0	6
3 in		0	7
2½ in in ebony cocus box &c		0	10
3 in		0	11
Fixing pushes and connecting to wires		1	0

SWITCHES

					s	d
Switches lever	1 way	round walnut base ordinary		each	0	9
„	2 way				0	10
	1 way	square			0	9
	2 way				0	10
„ plug	1 way	round	medium		2	6
„	2 way		„	„	3	9

WIRES

				s	d
Copper wire tinned covered with india rubber coloured cotton lapped best quality and highly paraffined No 1/22 S W G			per 110 yds	4	0
Ditto	ditto	1/20		4	9
Ditto	ditto	1/18		9	0
Single wire double cotton lapped fancy colours tarred and paraffined best quality No 22 S W G				2	6
Ditto	ditto	20		3	6
Staples for fixing	coppered wire ½ in to 1 in		per gross	3d	to 6d
	tinned wire			5d	7d
	coppered steel ½ in to 2 in		per lb	7d	9d
	tinned steel			8d	10d

FIXED COMPLETE

				s	d
Electric bells fixed complete including all material apparatus labour and profit		common quality	per push	10	0
Ditto	ditto	ordinary		20	0
Ditto	ditto	good		25	0
Ditto	ditto	best		30	0
Ditto	ditto	expensive		40	0
Add for each additional floor				3	0

For large numbers over 20 pushes these costs will be reduced

ANALYSIS

SPRING AND CRANK BELLS

Description —The ordinary house bells with cranks and wires &c are usually let to bellhangers at so much a pull complete but no reliable data can be obtained for analysing them in detail a great deal depending on the length of working and the corners to be negotiated Wire should be 16 gauge for indoor work and 14 gauge for outdoor well stretched before fixing Zinc tubing is commonly used but galvanised iron is better and little dearer copper is expensive Quantities would have to be taken out in each case Common 14 ozs house bells (with screw zinc tubing cranks copper wire clock springs staples &c) can be hung complete from 12s to 18s per pull according to the number of stories in the building To these materials and labour

must be added the cost of the bell itself, spring, carriage, and pull Thus, take the following item —

House Bells hung complete, with Secret Tubing, &c —If the house is two stories the price per pull as foregoing would be about 16*s* Add other items as stated

	s	*d*
Zinc tubing cranks wire, check springs staples, &c, and	16	0
	1	0
	2	6
	2	0
Fixing ditto say 1 hour bellhanger	0	10
Price per pull complete	22	4

Bells hung without secret tubing can be fixed for only 4*s* 6*d* to 9*s* per pull according to the number of stories, to which add bell spring carriage bell pull &c as above

Bell pull Lever, and Fixed —This is more fully described as a bell pull lever, with white or black knob, including screws &c The trade discount may vary from 10 to 25 per cent Price 5*s* less say 6*d* discount = 4*s* 6*d* net Add screws, labour fixing, and profit

	s	*d*
Bell pull lever net cost	4	6
¼ doz iron screws at 2*s* per gross	0	1
Fixing ½ hour bellhanger at 9½*d*	0	6
	5	1
Add 20 per cent profit &c	0	11
Price of each	6	0

Other items are analysed in the same way, namely article screws, fixing and profit

Speaking Tubes

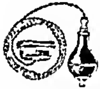
These comprise a length of metal tubing with bends, up and down from room to room, a short piece of flexible tubing (in 1¼, 2, 2½ or 3 ft lengths) at each ... with the r... zinc ... but f... bends enamelled steel conduit tubing is ... Remember to have a smooth inner surface, air tight joints, and to avoid bends The following dimensions and descriptions are merely imaginary to show how the whole cost may be arrived at in detail

Speaking Tube

	s	d
40 ft run of ¾ in socketed zinc speaking tube at 4*d*	13	4
4 socket bends or circular elbows for ditto at 8*d*	2	8
	0	6
	9	0
	2	6
	5	0
	1	2
	1	0
	9	8
	44	10
Add 20 per cent profit &c	8	11
Total price complete	53	9

Electric Bells

Electric bells are fast displacing the old fashioned house bells, with their clumsy wires, cranks springs, &c The builder will invariably go to a firm supplying electrical



Suspension Push Set

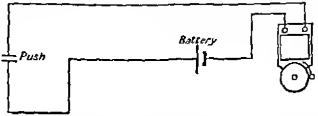
sity of attempting an analysis of cost him self The following example of a simple case is however, given as a rough guide, and may prove useful It is only approximate as so much depends upon the value of the furniture selected the arrangement of the pushes and the number of fittings put up at one time Electric bells fixed complete including all material, apparatus and labour may thus cost anything between 10s and 40s per push Ordinary say 20s

Example

	s	d
Electric trembling bell medium quality 3 in gong	5	3
Battery Leclanché sealed cell 2 pint (quart	1	6
Indicator with self replacing pendulum 6 Numbers each	2	6
3 in wood push best quality in cherry or walnut	0	7
Copper wire braided and paraffined No 18 S W G say 30 yds at 4s per 110 yds	1	1
Staples tinned wire 4 d z at 7d per gross	0	2
Fixing f ring 4 hrs bell hanger and labourer at 9d and 7d	5	6
	16	7
Add 20 per cent profit &c	3	5
Price per push complete	20	0

Attendance, &c—For attendance of other trades in cutting away and making good add 20 per cent on the amount of the bellhanging itself Floor boards above wires should be fixed with brass cups and screws and made movable for repairs, wooden casings the same

Trade discount 10 to 25 per cent off list prices



Simple Bell Circuit.

Bell and Cell connected to one push The current flows from positive pole of the battery to the terminal through the bell to terminal and thence by the wire and push springs to the negative pole Push is represented thus ═, Battery ⊩ the long line indicating the carbon and the short zinc

CHAPTER XVIII.—PLUMBER.

MEMORANDA

WEIGHTS AND THICKNESSES OF SHEET LEAD

Weight per foot super	Thickness in inches	Nearest simple fraction	Weight per foot super	Thickness in inches	Nearest simple fraction
lbs	in		lbs.	in	
1	0·017	$\frac{1}{60}$	8	0·136	$\frac{1}{8}$
2	0·034	$\frac{1}{30}$	9	0·153	$\frac{1}{7}$
3	0·051	$\frac{1}{20}$	10	0·169	$\frac{1}{6}$
4	0·068	$\frac{1}{16}$	11	0·186	$\frac{3}{16}$
5	0·085	$\frac{1}{12}$	12	0·203	$\frac{1}{5}$
6	0·102	$\frac{1}{10}$	15	0·255	$\frac{1}{4}$
7	0·118	$\frac{1}{8}$	59	1·000	—

Milled lead is rolled in sheets 20 to 40 ft. long, and 6 to 9 ft. wide, and is made from 1 to 20 lbs. weight per ft. sup.

Cast lead is made in sheets 16 to 18 ft. long, and 6 or 7 ft. wide.

Weight.—Milled lead 712 lbs. per ft. cub., and cast lead 709 lbs.

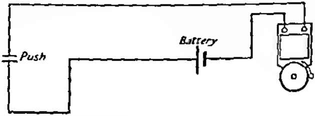
LEAD WASTE, SOIL, AND VENTILATING PIPES.
(WEIGHT PER 10 FT. LENGTH.)

Internal Diameter	6 lbs. Lead or ·102 in. thick	7 lbs. Lead or ·118 in. thick	8 lbs. Lead or ·136 in. thick	10 lbs. Lead or ·169 in. thick
in.	lbs.	lbs.	lbs.	lbs.
$2\frac{1}{2}$	41	48	55	—
3	49	57	66	—
$3\frac{1}{2}$	57	67	76	97
4	65	76	87	110
$4\frac{1}{2}$	73	85	97	122
5	80	94	107	136
6	94	112	128	164

Waste and ventilating pipes are usually of 6 lbs. lead, and soil pipes of 7 or 8 lbs. lead, made in 10 ft. lengths.

Attendance, &c —For attendance of other trades in cutting away and making good add 20 per cent on the amount of the bellhanging itself Floor boards above wires should be fixed with brass cups and screws and made movable for repairs wooden casings the same

Trade discount 10 to 25 per cent off list prices



Simple Bell Circuit.

Bell and Cell connected to one push The current flows from positive pole of the battery to the terminal, through the bell to terminal, and thence by the wire and push springs to the negative pole Push is represented thus ═ Battery ╢ the long line indicating the carbon and the short zinc

CHAPTER XVIII.—PLUMBER.

MEMORANDA

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3	0·051	1/20	10	0·169	1/6
4	0·068	1/15	11	0·186	1/5
5	0·085	1/12	12	0·203	5/24
6	0·102	1/10	15	0·255	1/4
7	0·118	1/8	59	1·000	—

Milled lead is rolled in sheets 20 to 40 ft long, and 6 to 9 ft wide, and is made from 1 to 20 lbs weight per ft sup

Cast lead is made in sheets 16 to 18 ft long, and 6 or 7 ft wide

Weight.—Milled lead, 712 lbs per ft cub, and cast lead 709 lbs

Lead Waste, Soil, and Ventilating Pipes
(Weight per 10 ft Length)

Internal Diameter	6 lbs Lead or ·10 in thick	7 lbs Lead or ·118 in thick	8 lbs Lead or ·136 in thick	10 lbs Lead or ·169 in thick
in	lbs	lbs	lbs	lbs
2½	41	48	55	—
3	49	57	66	—
3½	57	67	76	97
4	65	76	87	110
4½	73	85	97	122
5	80	94	107	136
6	94	112	1[illegible]3	164

Waste and ventilating pipes are usually of 6 lbs lead and soil pipes of 7 or 8 lbs lead made in 10 ft lengths

Metropolitan Drawn Lead Pipes

(Thickness and Weight per Yard Run)

Internal Diameter	Light (Waste Pipes)		Middling (Service Pipes)		Strong (Supply Pipes)	
	Thickness	Weight	Thickness	Weight	Thickness	Weight
in	in	lbs	in	lbs	in	lbs
½	11	3	14	4	19	6
¾	12	5	15	6	20	9
1	13	7	16	9	21	12
1¼	14	9	18	12	22	15
1½	15	12	19	16	22	18
1¾	16	14	19	18	23	21
2	16	16	20	21	23	24
2½	17	18	20	26	24	33

Lead pipes ¼ to 1 in diam are made in coils of 20 yds or lengths of 15 ft
1¼ to 2 ... 12 ... 12
2½ to 6 ... lengths of 10 12 and 15 ft

Wiped Soldered Joints

long

1¼ in	1¾ lbs	3 in
1½ in	2 lbs	3 in
2 in	2¼ lbs	3¼ in
2¼ in	2¼ lbs	3¼ in
2½ in	3 lbs	3¼ in
3 in	3½ lbs	3½ in
3½ in	4 lbs	3½ in
4 in	4½ lbs	3½ in

ion

ted from freezing
ce 30 ft long will
expand about 1 in

Weights and Sizes of Average Baths

Material	Weight	Dimensions	ft	in
Sheet copper (32 ozs per f s)	80 lbs	Internal—	ft	in
Enamelled cast iron	300 lbs	Length	5	6
Slate	500 lbs	Width at head	2	6
Enamelled Fireclay	500 lbs	Width at foot	1	6
Marble	600 lbs	Depth	1	?

Parallel baths about 2 ft wide throughout 3 to 4 in roll r m
Holds when full about 100 gals but 30 gals for ablution purposes

SOLDERED JOINTS TO LEAD PIPES

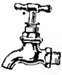
	½ in	¾ in	1 in	1¼ in	1½ in	1¾ in	2 in	2¼ in	2½ in
Solder, lbs	75	1·00	1 25	1 50	1 75	2 00	2 25	2 50	3 00
Coals cwt	05	06	07	08	09	10	11	12	13
Plumber and labourer, hrs	40	45	50	55	60	65	70	75	80
Each									

PRICES

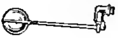
LEAD WORK

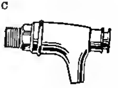
		s	d
Milled sheet lead, supplied only, any portion of a roll	per cwt	20	0
Recasting or remilling old lead, or exchanging			
	„	13	0
	„	2	0
	„	5	0
	„	30	0
&c	„	31	0
Sheet lead taken up and removed to store	„	2	0
Close iron nailing, ½ to 1 in apart, to lead	per ft run	0	2
„ zinc „ „ „	„	0	2½
„ copper „ „ „	„	0	4
For open nailing deduct 33 per cent from foregoing			
Soldering joints (1 lb to 1½ lbs of solder per foot)			
	„	1	6
	„	0	9
	„	0	1½
	„	0	3
	„	0	9
	„	0	3
	„	0	3
„ „ „ double	„	0	4
Dressing to 1½ in rounded edges	„	0	2
Soldered seam	„	1	1
„ angle	„	1	3
Extra labour and solder to cesspool (10 in × 10-in × 6-in)	each	4	6
Soldered tacks or dots, including brass screws	„	1	3
Bossed ends to rolls	„	0	6
Intersection of two rolls	„	0	9

Brass Cocks, Taps, &c


Bib Cock

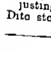

Stop Cock

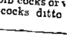

Ball Valve

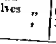

Push Tap

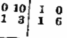
Description		½ in	¾ in	1 in	1¼ in	1½ in
		s d	s d	s d	s d	s d
Screw down brass bib cocks, screwed or plain ends	each	3 0	4 6	6 6	10 9	18 0
Screw down gunmetal stop cocks screwed or plain	,,	3 6	5 9	9 0	16 0	23 0
High pressure horizontal ball valve, including copper ball and rod complete	,	4 0	5 6	8 0	16 0	22 6
Self closing spring push valve s o	,,	4 0	5 3	7 0	—	—
Tylor s The Waste not bib tap	,,	5 3	8 6	12 8	—	—
Add to the above items if with screwed end	,,	0 3	0 6	0 9	1 1	1 9
Ditto if with single fly nuts as for boilers, slate cisterns &c	,,	0 7	1 0	1 7	2 3	3 6
Ditto if with brass lever handles and fitting	,,	0 9	1 0	1 3	1 6	2 0
Fixing cocks and valves including washers &c	,,	0 5	0 6	0 7	0 8	0 9
Ditto bib cocks and valves with one soldered joint	,	0 11	1 2	1 6	1 10	2 6
Ditto with two soldered joints	,,	1 10	2 4	3 0	3 8	5 0
Easing regulating and adjusting bib cocks or valves	,,	0 10	1 0	1 4	1 8	2 4
Dito stop cocks ditto	,	1 3	1 6	1 9	2 1	2 9

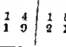
Ferrules Unions, &c

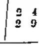

Elbow Ferrule Ground in Union


Union Joint for Iron and Lead Pipes


Union Joint for Iron Pipe female ends


Union Joint for Lead Pipe


Ground Union Joint for Iron Pipe male and female


Bent Union Ferrule.

Ferrules Unions &c —continued

Description	½ in	¾ in	1 in	1¼ in	1½ in
	s d	s d	s d	s d	s d
Ferrules straight or elbow, with ground union joint each	1 0	1 6	2 2	3 0	4 0
Ditto ditto screwed for iron	0 9	1 2	1 11	2 10	3 9
Add to two last if fixed	0 10	1 0	1 3	1 7	2 0
Union joints for iron pipes	1 3	1 9	2 6	4 2	4 10
Ditto if fixed solder joint	1 7	2 4	3 0	4 6	6 0
Union joints for lead pipes	0 10	1 4	2 3	3 1	4 0
Ditto if fixed including two soldered joints	3 0	4 3	5 6	7 0	9 0
Brass screw union with fly nut for iron and soldered joint to lead pipe	3 0	4 0	5 0	6 0	7 0

Connection with Water Company s main say 25s

Water Closets

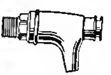
	s	d
Ordinary wash down closet pan and trap in one s o each	30	0
Mahogany seat 1¼ in thick with extension and back rail	15	6
Add for polished mahogany cover or flap	8	0
Galv iron brackets for closet seats	1	3
Cans and white enamelled stoneware trap	4	0
The Unitas white plain pedestal	38	0
raised and ornamented	42	0
Doulton s white Queensware Simplicitas closet with metallo keramic joint basin only	53	0
W C combination silent closet including pedestal mahogany seat cast iron cistern immediately above flush		
	110	0
	150	0
	63	0
	18	0
	?0	0
	38	0
	24	0
	26	
Galv cast iron brackets for above cisterns	1	6
Fixing only W W P cisterns cover brackets chain pull and soldered joints to supply and overflow pipes	5	0
Field s galv iron self acting flushing siphon cistern 10 gals	?0	0
Ditto ditto 20 gals	100	0
Ditto ditto 50 gals	130	0
Ditto ditto ?0 gals	150	0
Ditto ditto 80 gals	160	0
Ditto ditto 100 gals	180	0

Brass Cocks, Taps, &c

Bib Cock

Stop Cock

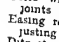
Ball Valve



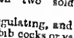
Push Tap

Description		½ in	¾ in	1 in	1¼ in	1½ in
		s d	s d	s d	s d	s d
Screw-down brass bib cocks, screwed or plain ends	each	3 0	4 6	6 6	10 9	18 0
Screw down gunmetal stop cocks screwed or plain	"	3 6	5 9	9 0	16 0	23 0
High pressure horizontal ball valve, including copper ball and rod complete	"	4 0	5 6	8 0	16 0	22 6
Self closing spring push valve, s o	"	4 0	5 3	7 0	—	—
Tylor's 'The Waste not' bib tap	"	5 3	8 6	12 8	—	—
Add to the above items if with screwed end	"	0 3	0 6	0 9	1 1	1 9
Ditto if with single fly nuts, as for boilers, slate cisterns &c	"	0 7	1 0	1 7	2 3	3 6
Ditto if with brass lever handles and fitting	"	0 9	1 0	1 3	1 6	2 0
Fixing cocks and valves including washers, &c	"	0 5	0 6	0 7	0 8	0 9
Ditto bib cocks and valves with one soldered joint	"	0 11	1 2	1 6	1 10	2 6
Ditto with two soldered joints	"	1 10	2 4	3 0	3 8	5 0
Easing regulating, and adjusting bib cocks or valves	"	0 10	1 0	1 4	1 8	2 4
Ditto stop cocks, ditto	"	1 3	1 6	1 9	2 1	2 9

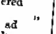
Ferrules, Unions, &c



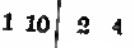
Elbow Ferrule Ground in Union



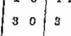
Union Joint for Iron and Lead Pipes



Union Joint for Iron Pipe, female ends



Union Joint for Lead Pipe.



Ground Union Joint for Iron Pipe male and female

Bent Union Ferrule

FERRULES UNIONS &c—*continued*

Description	½ in	¾ in	1 in	1¼ in	1½ in
	s d	s d	s d	s d	s d
Ferrules straight or elbow with ground union joint each	1 0	1 6	2 2	3 0	4 0
Ditto ditto screwed for iron	0 9	1 2	1 11	2 10	3 9
Add to two last if fixed	0 10	1 0	1 3	1 7	2 0
Union joints for iron pipes	1 3	1 9	2 6	4 2	4 10
Ditto if fixed solder joint	1 7	2 4	3 0	4 6	6 0
Union joints for lead pipes	0 10	1 4	2 3	3 1	4 0
Ditto if fixed including two soldered joints	3 0	4 3	5 6	7 0	9 0
Brass screw union with fly nut for iron and soldered joint to lead pipe	3 0	4 0	5 0	6 0	7 0

Connection with Water Company s main say 25*s*

WATER CLOSETS

	s	d
Ordinary wash down closet pan and trap in one s o each	30	0
Mahogany seat 1¼ in thick with extension and back rail	15	6
Add for polished mahogany cover or flap	8	0
Galv iron brackets for closet seats	1	3
Cane and white enamelled stoneware trap	4	0
The Unitas white plain pedestal	38	0
raised and ornamented	42	0
Doulton s white Queensware Simplicitas closet with metallo keramic joint basin only	53	0
W C combination silent closet including pedestal mahogany seat cast iron cistern immediately above flush bend &c complete s o	110	0
Hellyer s Optimus valve closet with copper regulator	150	0
Moule s earth closet pull up with galv iron rim and [illegible]	63	0
[illegible]	18	0
[illegible] with hard [illegible] and 6 ft of flush pipe complete with joints	20	0
Winn s Acme galv iron 3 gals siphon cistern s o	38	0
The Peckham galv iron W W P cistern 2 gals	24	0
Twyford s National ditto with brass chain and pull	26	
Galv cast iron brackets for above cisterns	1	6
Fixing only W W P cisterns cover brackets chain pull and soldered joints to supply and overflow pipes	5	0
Field s galv iron self acting flushing siphon cistern 10 gals	70	0
Ditto ditto 20 gals	100	0
Ditto ditto 50 gals	130	0
Ditto ditto 70 gals	150	0
Ditto ditto 80 gals	160	0
Ditto ditto 100 gals	180	0

Urinals

s d

All glazed fireclay rounded back stall urinals in ranges complete with automatic flushing cistern flush pipes channels divisions &c supplied only buff or cane enamelled per stall £5 to £7

£7 to £9

£10 to £12

each 16 0

21 0

9 0

Cocks for urinals with unions both ends 3 0

Fixing only flat backed urinals including waste pipe 4 0

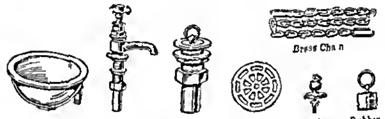
angular

Copper sparge pipe ¾ in diam and fixed per ft run 1 9

Extra for stopped end or cap to ditto each 0 8

Zinc sparge pipe ¾ in diam and fixed per ft run 0 9

Lavatory Basins



Brass Chain

Round Plug Basin — Lavatory Valve — Basin Outlet with Vulcanite Plug — Cobweb Grating — Holder or Stay — Rubber Plug

s d

Round plug basin white 12 in with overflow 5 0 each 4 0

14 in 4 6

16 in 6 0

Add if fixed including screws and red or white lead 4 0

5 0

7 0

70 0

90 0

enamelled slate top and skirting 9 3

Cam action lavatory valve hot or cold yellow metal 5 0

½ in self closing spring push valve nickel plated 8 6

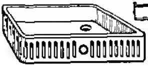
¾ in brass and gunmetal screw down lavatory valve 10 6

¾ in nickel plated 7 3

¾ in spring stop valve screwed for iron 4 6

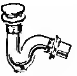
Brass flat link chain strong supplied only doz yds

Sinks



Kitchen Sink

Sink Bracket



Cast iron Sink Trap

Tye and Andrews Trap

		s	d
Fireclay white enamelled inside and out kitchen sink 36 in × 22 in × 10 in supplied only	each	49	6
Jenning's glazed fireclay pantry sink 42 in long with valves &c		140	0
Ordinary whiteware slop sink 20 in × 20 in with trap &c		90	0
Twyford's slop hopper for hospitals enamelled with			
		180	0
		90	0
		200	0
Tye and Andrews galvanised iron sink trap 2 in		7	0
Washer and plug with brass grating for 2 in waste		3	6

Baths

	each	120	0
		21	6
		27	6
		130	0
		90	0
		300	0
Zinc bath		90	0
Enamelled fireclay bath		270	0
		6	0
		380	0
		30	0
		200	0

Hot water Pipes &c

List prices for hot water pipes by a well known firm of heating engineers Add fixing and profit

Description		3 in	4 in
		s d	s d
Socket pipes in 6 or 9 ft lengths	per yard	2 9	2 8
Trough		1 2	1 4
Coil or spigot pipes in 6 or 9 ft lengths		2 7	2 9

Hot water Pipes, &c—*continued*

Description		3 in		4 in.	
		s	d	s	d
Inside bend spigot and socket	each	2	3	3	9
Outside	"	4	0	6	0
Diminishing bend 4 in to 3 in	"	2	3	3	9
Outside	"	4	0	6	0
Eighth bends double sockets outside	"	3	9	5	3
inside	"	3	0	4	6
Tee piece with socket end	"	3	9	5	4
Throttle valve spigot and socket	"	12	6	15	9
double sockets	"	12	6	15	9
Three way siphon	"	4	9	6	9
Four way siphon	"	6	0	10	6

Weight—3 in pipes weigh 42 lbs per yard, and 4 in pipes 66 lbs

Cost of Heating by Hot Water

Including Boiler Pipes and Radiators, but excluding Buildings

	£
Churches	1 per 1 000 f c
Factories	2 " "
Hospitals	3 " "
Mansions	4 " "

Materials

(without profit)

		s	d
Canvas packing cored round or square	per lb	2	0
Cement red lead or white lead for joints	"	0	3½
Chains brass small link	"	1	6
galv iron ditto	"	0	6
Charcoal alder or willow	per bushel	1	6
animal	"	18	0
Closet cone indiarubber strengthened with canvas covering	each	1	6
Cloth soldering linen tick	per yard	2	0
Collars and washers lead for small pipes or cocks	each	0	9
leather	"	0	1½
Dubbin	per lb	0	5
Felt for flanges cut to shape	per ft sup	0	6
Guttapercha sheet in thick	per lb	3	0
Hooks wrot iron wall or pipe ¼ lb each or under	"	0	2½
galvanised	"	0	4
Indiarubber vulcanised for flanges of pipes &c	"	5	0
Indiarubber solution	per gal	6	0

MATERIALS—*continued*

		s	d
Red lead ground in oil	per lb	0	3½
White lead	,	0	3½
Lead for collars and flanges of large pipes cut to size		0	3
Lead for running		0	3
Leather oil dressed for collars flanges valves &c cut to size		3	0
Resin or rosin		0	2
Sal ammoniac, white crystal or powdered		0	7
Spirits of salts (muriatic acid)	per pint	0	6
Soda caustic	per lb	0	3
, common crystal		0	0¼
Solder plumber s (1 tin to 2 lead)		0	8
tinman s (2 tin to 1 lead)		1	0
Sulphur roll or powdered		0	3
		0	5
		1	11
		0	5
	per ft run	0	9
		1	0
1		1	9
Washers lead	per lb	0	4
brass		1	6
Wire brass		1	0
copper		1	3
galv iron		0	8

WAGES

Wages plumber s	per hour	0	11
plumber s mate		0	7

ANALYSIS

Discount—The trade discount off plumber s brasswork is ... m 10 to 15 per cent Discount 2½ per cent for cash ... count off sanitary goods such as baths lavatory basins, c... ets &c 10 to 20 per cent

Old Lead—The allowance for waste dross dirt or tare on old lead or for exchanging new lead for old or for re casting or re milling old lead varies from 4 to 8 lbs per cwt (6 lbs average) Solder if in considerable quantity, is cut out and sold separately

Flats, Gutters and Flashings—In this class of work the expansion and contraction of the metal constantly has to be allowed for Sheets not more than 2 ft 6 in or 3 ft wide and drips not more than 7 or 8 ft apart Flats should have a minimum fall of 1 in in 10 ft, and drips at least 2 in high

In gutters a fall of $1\frac{1}{2}$ in in 10 ft is usually allowed and the lead run up 9 in under the slates and 6 in vertically up the walls

Flashings should be well wedged with lead wedges into a joint of the brickwork and then be pointed in Portland cement Where they are inserted into a groove or chase in stonework they can be burnt in —or more accurately melted in—by forming a temporary clay trough under the chase and then pouring in melted lead Soakers ought to extend laterally for about half the width of a slate in addition to the part which is bent up vertically against the wall Cover flashings overhang the lead they cover to a depth of 4 in

Where lead has to be secured tightly to woodwork which must be as seldom as possible on account of its expansion and contraction lead dots may be used They are made by slightly hollowing a place in the woodwork dressing the lead into the hollow driving a strong brass screw through the metal and the woodwork in the centre of the hollow and then filling up the depression in the lead with solder

All soil and ventilating pipes are best blocked out from the walls so as to avoid the use of bends or knees at plinths &c and made to pass straight through the eaves instead of around them

Solders —Plumbers solders are composed of tin and lead Coarse solder which melts at about 480° Fahr contains 1 part tin to 3 parts lead Ordinary solder melting at about 440° is composed of 1 part tin to 2 parts lead

Fine solde ... parts
of tin and le
1 part lead
quantity of
and pewterer s fine solder which consists of 2 parts tin
to 1 lead
water I
are used
by a cop
make stronger joints are melted over the fire and applied with a ladle

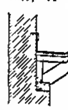
Ordinary plumber s solder is generally priced at 8 *l* per lb
but the net trad ... of 8 legs
each weighing
18 in × $\frac{1}{2}$ in
net trade price

Average Market Prices

(April 1912)	Per ton £ s d		Per cwt £ s d		Per lb d
Sheet lead 4 lbs and upwards	20 0 0	=	1 0 0	=	2¼
Pig lead in 1 cwt pigs	17 10 0	=	0 17 6	=	1¾
Solder plumber in ½ cwt casts	68 0 0	=	3 8 0	=	7¼
Old lead against account	15 5 0	=	0 15 3	=	1¾
Lead water pipe	20 10 0	=	1 0 6	=	2¼
Lead barrel pipe	21 10 0	=	1 1 6	=	2¼
Lead soil pipe	23 10 0	=	1 3 6	=	2½
Lead pipe tinned inside only	22 10 0	=	1 2 6	=	2½
Lead pipe tinned inside and out	25 0 0	=	1 5 0	=	2¾

Foregoing are Town prices country rates are 15s per ton more

Milled Lead and Laying in Gutters, Flats, &c—The price of sheet lead (April, 1912) is £20 per ton, or 20s per cwt, if cut to size 6d per cwt extra, or 20s 6d Free delivery in London by merchant if a cartload is ordered [illegible] as they [illegible] solder or [illegible] not supposed to be employed in this class of work and fuel for firing may be waste pieces of wood or shavings (Inferior weight is sometimes substituted for that specified)



Lead Gutter

	s	d
[illegible]	20	0
[illegible]	0	6
[illegible]	0	0
[illegible]	4	6
	25	0
Add 20 per cent profit &c	5	0
Price per cwt	30	0

Labour (4 hours plumber and mate) and solder for milled lead in cisterns safes, and sinks, &c, would be about 7s per cwt

Lead per Square—7 lbs lead in roofs, including gutters, rolls, flashings aprons, &c works out to about £10 per square, material labour and profit, but exclusive of boarding or bearers

100 f s × 7 lbs = 700 lbs ÷ 112 = 6¼ cwt × 30s £10 per square

Milled Lead in Flashings, Aprons Soakers &c—The lead for this costs about 6d more per cwt than for gutters and

flats, and a trifle extra labour, making a total of 31s 6d per cwt

Soldered Angle —Allow **1 lb** solder per foot run in the wiped angle of a lead lined sink, the shaving being $\frac{3}{4}$ in on each side of the angle, and 1½ lbs. solder for cistern with 1 in shaving Add firing and labour

	s	d
1 lb plumber s solder at 8d	0	8
Fuel for firing (old wood)	0	0
Labour ½ hour plumber and mate, at 11d and 7d	0	4½
	1	0½
Add 20 per cent profit &c	0	2½
Price per foot run	1	3

Bossed Ends to Rolls —These mean extra labour and solder and they are worth from 6d to 9d each, including profit

Lead Pipes —In some schedules and lists these are taken at per cwt of all sizes, but in ordinary bills of quantities they are priced at per foot run

¾ in Strong Lead Pipe and Fixing —By a reference to the "Memoranda it will be seen that this size and strength weigh 9 lbs per yard or 3 lbs per foot run Lead pipe is worth more than sheet lead, about 1s, or 21s per cwt

	s	d
3 lbs lead pipe at 21s per cwt = per foot	0	6¾
Solder and fuel for firing	0	0½
Wall hooks 2 ft apart	0	0½
Labour ½ hour plumber and mate at 11d and 7d	0	3½
	0	11
Add 20 per cent profit &c	0	2
Price per foot run	1	1

Soldered ends to ditto 6d each, including profit

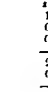
Other sizes of pipes are worked out similarly, and the cost of solder wall hooks and labour (without piping or profit), would be —

½ in	¾ in	1 in	1¼ in	1½ in	2 in
3d	4½d	5½d	7d	8½d	11d

Soldered Joint to 1½ in Lead Pipe —This is made up as follows but the amount of solder will vary with the workman (See Memoranda) As this sized pipe is made in coils of 12 yds or in lengths of 4 yds, it practically means a joint every 12 ft

	s	d
1¾ lbs pl mber s solder at 8d	1	2
Fuel for f ring (old wood or shavu gs)	0	0
⅔ hour plumber and mate at 11d an d 7 l	0	11
	2	1
Add 20 per cent prof t &c	0	5
Price of each	2	6

4 in Soil Pipe of 8 lbs Lead and fixed with Joints and Tacks—This is the usual size and weight specified A 4 in diameter pipe is rather more
is 87
this
4 in hydraulic mill drawn pipes are made in 10 ft lengths where a wiped soldered joint will occur 3½ in long and requiring 4½ lbs solder Soil p pe costs 3s 6d per cwt more than sheet lead or 23s 6d total For fastening to wall tacks or pieces of lead are used These are of 6 or 7 lbs lead 10 in deep and fixed singly or in pairs two or three per 10 ft length of pipe They are merely soldered to the back of pipe and secured to brickwork by wrot iron wall hooks 2 or 3 per single tack and 4 to 6 per double tack



So l 1 pe

D ble Ta k

3 in wrot iron wall hooks	11	weigh 1 lb
4 in	7	
5 in	5	
6 in	4	

Price 21s per cwt = 2¼d per lb

A common way is to fix alternately three single 10 in × 9 in tacks folded over to protect the hooks to each length Cast lead single or double tacks are more ornamental and stronger for good class work

Analyse a 10 ft length and divide for price per foot run

	s	d
	18	3
	3	0
	0	2¼
	2	7½
	4	6
	1	1
Carried forward	30	8

	s	d
Brought forward	30	8
3/4 – 12 – 1¾ lbs of 4 in wrot iron wall hooks at 2½d per lb	0	4
Fixing soil pipe and tacks 6 hours plumber and mate at 11d and 7d	9	0
	40	0
Add 20 per cent profit &c	8	0
	10)48	0
Price per foot run	4	10

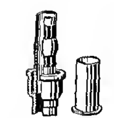
Bends and branches are charged separately and joints numbered. Cast iron soil and ventilating pipes are priced under *Smith*.

Boyle's Air pump Ventilator, and Fixed.—Boyle's patent Air pump ventilator is commonly used for top of soil pipe to induce an up draught. Design No 227 cheap form galvanised and painted 8 in diameter head 4 in diameter pipe.


Soil Pipe Ventilator

	s	d
Cost of 8 in ventilator	10	6
2 hours plumber at 11d	1	10
4 lbs plumber's solder at 8d	2	8
Fuel for firing say	0	2
	15	2
Add 20 per cent profit &c	3	0
Price of each	18	2

Connection of Soil Pipe with Drain.—The ordinary connection between a lead soil pipe and a stoneware drain is to slip a brass ferrule or thimble over the foot of former and outside which stiffens it and makes only one internal joint. The ferrule is held at top externally by a wiped soldered joint and at bottom caulked with yarn and a cement joint into socket of stoneware drain. A concrete base (not here taken up) supports bend of latter and the yarn and cement joint would come under *Drainlayer*.


Soil Pipe and Drain. Brass ferrule.

	s	d
Brass ferrule 4½ in bore and 5 in long	3	9
4½ lbs plumber's solder at 8d	3	0
¼ cwt coal (fuel) at 20s per ton	0	2½
2 hrs plumber and mate at 11d and 7d	3	0
	9	11½
Add 20 per cent profit &c	2	0½
Price of each	12	0

Drawn Lead Traps.—8 lbs. lead is best used in these. One soldered joint is taken. For amount of solder see 'Memoranda.'

	s.	d.
2 in. P trap of 8 lbs. lead	3	0
Add if with brass cap and screw	0	7
1 joint 2¼ lbs. plumber's solder at 8d.	1	6
Fuel for firing, say	0	1
1 hour plumber and mate at 11d. and 7d.	1	6
	6	8
Add 20 per cent. profit, &c.	1	4
Price of each	8	0

	s.	d.
4 in. S trap of 8 lbs. lead	10	0
Add if with brass cap and screw	0	10
1 joint 4½ lbs. plumber's solder at 8d.	3	0
Fuel for firing, say	0	2
1¾ hour plumber and mate at 11d. and 7d.	2	8
	16	8
Add 20 per cent. profit, &c.	3	4
Price of each	20	0

Fittings and Brasswork.—Plumber's fittings and brass work comprise a large variety of articles and can only be valued by referring to the illustrated catalogues and price lists of well known manufacturers. But the labour in fixing, soldering, &c., is not so easily found, as the time required by a plumber and his mate is seldom uniform. The analysis is simple and easy enough, however, and it is only necessary to give a few examples. The difference between good and cheap plumbing is very great, as lighter weights can be easily substituted for the heavy ones specified.

Pantry Plug.


Chain and Stay.

2 in. *Pantry Washer, Plug and Chain*, with perforated bottom for sink, and fixing complete.

	s.	d.
Washer and waste with plug and chain	3	6
1 joint 2¼ lbs. plumber's solder at 8d.	1	6
Fuel for firing, say	0	1
1 hour plumber and mate at 11d. and 7d.	1	6
	6	7
Add 20 per cent. profit, &c.	1	4
Price of each	7	11

	s	d
Brought forward	30	8
3/4 − 12 = $1\frac{3}{4}$ lbs of 4 in wrot iron wall hooks at $2\frac{1}{4}d$ per lb	0	4
Fixing soil pipe and tacks 6 hours plumber and mate at 11*l* and 7*d*	)	0
	40	0
Add 20 per cent profit &c	8	0
	10)48	0
Price per foot run	4	10

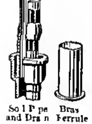
Bends and branches are charged separately and joints numbered. Cast iron soil and ventilating pipes are priced under *S i* *l*

Boyle s Air pump Ventilator, and Fixed—Boyle s patent Air pump ventilator is commonly used for top of soil pipe to induce an up draught Design No 227 cheap form galvanised and painted 8 in diameter head 4 in diameter pipe

Soil Pipe Ventilator

	s	d
Cost of 8 in ventilator	10	6
2 hours plumber at 11*d*	1	10
4 lbs plumber s solder at 8*d*	2	8
Fuel for firing say	0	2
	15	2
Add 20 per cent profit &c	3	0
Price of each	18	2

Connection of Soil Pipe with Drain—The ordinary connection between a lead soil pipe and a stoneware drain is to slip a brass ferrule or thimble ... which ... nal joir ... nally by a wiped soldered joint and at bottom caulked with yarn and a cement joint into socket of stoneware drain A concrete base (not here taken up) supports bend of latter and the yarn and cement joint would come under *Drainlayer*



Soil Pipe and Drain Brass Ferrule

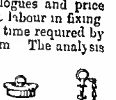
	s	d
Brass ferrule $4\frac{1}{2}$ in bore and 5 in long	3	9
$4\frac{1}{2}$ lbs plumber s solder at 8*d*	3	0
$\frac{1}{4}$ cwt coal (fuel) at 20*s* per ton	0	$0\frac{1}{4}$
2 hrs plumber and mate at 11*l* and 7*l*	3	0
	9	$11\frac{1}{4}$
Add 20 per cent profit &c	2	$0\frac{1}{4}$
Price of each	12	0

Drawn Lead Traps.—8 lbs. lead is best used in these. One soldered joint is taken. For amount of solder see Memoranda.

	s.	d.
2 in. P trap of 8 lbs. lead	3	0
Add if with brass cap and screw	0	7
1 joint 2¼ lbs. plumber's solder at 8d.	1	6
Fuel for firing, say	0	1
1 hour plumber and mate at 11d. and 7d.	1	6
	6	8
Add 20 per cent. profit, &c.	1	4
Price of each	8	0

	s.	d.
4 in. S trap of 8 lbs. lead	10	0
Add if with brass cap and screw	0	10
1 joint 4½ lbs. plumber's solder at 8d.	3	0
Fuel for firing, say	0	2
1¾ hour plumber and mate at 11d. and 7d.	2	8
	16	8
Add 20 per cent. profit, &c.	3	4
Price of each	20	0

Fittings and Brasswork.—Plumber's fittings and brass work comprise a large variety of articles, and can only be valued by referring to the illustrated catalogues and price lists of well known manufacturers. But the labour in fixing, soldering, &c., is not so easily found, as the time required by a plumber and his mate is seldom uniform. The analysis



Pantry Plug. Chain and Stay.

2 in. *Pantry Washer, Plug and Chain*, with perforated bottom for sink, and fixing complete.

	s.	d.
Washer and waste with plug and chain	3	6
1 joint 2¼ lbs. plumber's solder at 8d.	1	6
Fuel for firing, say	0	1
1 hour plumber and mate at 11d. and 7d.	1	6
	6	7
Add 20 per cent. profit, &c.	1	4
Price of each	7	11

	s	d
Brought forward	30	8
3/4 – 12 – 1¾ lbs of 4 in wrot iron wall hooks at 2½ l per lb	0	4
Fixing soil pipe and tacks 6 hours plumber and mate at 11*d* and 7*d*	J	0
	40	0
Add 20 per cent profit &c	8	0
	10)48	0
Price per foot run	4	10

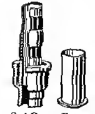
Bends and branches are charged separately, and joints numbered Cast iron soil and ventilating pipes are priced under *Smith*

Boyle s Air pump Ventilator, and Fixed—Boyle s patent ' Air pump ventilator is commonly used for top of soil pipe to induce an up draught Design No 227 cheap form galvanised and painted 8 in diameter head 4 in diameter pipe

So l P pe Vent lator

	s	l
Cost of 8 in ventilator	10	6
2 hours plumber at 11*d*	1	10
4 lbs plumber s solder at 8*d*	2	8
Fuel for firing say	0	2
	15	2
Add 20 per cent profit &c	3	0
Price of each	18	2

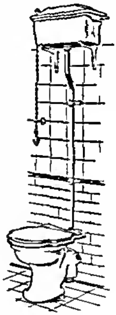
Connection of Soil Pipe with Drain—The ordinary con nection between a lead soil pipe and a stone ware drain is to slip a brass ferrule or thimble
which
nal join
nally by a wiped soldered joint and at bottom caulked with yarn and a cement joint into socket of stoneware drain A concrete base (not here taken up) supports bend of latter and the yarn and cement joint would come under *Drainlayer*



So l P pe and Dra n Brass Ferr le

	s	l
	3	J
	3	0
	0	2½
	3	0
	9	11½
Add 20 per cent profit &c	2	0½
Price of each	12	0

preventing cisterns and flush pipes but the undermentioned analysis is merely typical of a good kind ordinarily met with everything being shown separately and comprehensively for better information though some items are not always required The pedestal basin or pan is made of glazed vitrified or porcelain enamelled fireclay stoneware earthenware "Kingsware" or Queensware and may either have a straight front or curved cut away front and cost anything from 15s to 40s Size 20 to 26-in extreme length 13 in × 12 in up to 18-in × 16 in oval diameters (16-in × 14 in average) and 14 to 17 in high The trap is sometimes separate of ware lead or iron but all in one piece is more sanitary



W.C.

The seat may be merely a ring of wood which needs basin lugs for fasten [illegible]

oak teak walnut or mahogany polished or unpolished and 1 or 1¼ in thick

The W W P cistern is of cast iron painted galvanised or enamelled, with or without cover and commonly holds 2 gals., but better 3 gals with siphonic action cost 10s to 40s Ball valve brackets chain and pull are attached State pressure of water whether high or low when ordering It is best to select the precise article wanted out of a catalogue where the complete description is found

Flush pipe is 1¼ or 1½ in diameter and 5 to 6 ft long of lead but sometimes of painted or galvanised wrought iron seamless steel tube brass or nickel plated

Discount 10 to 20 per cent for a manufactory Packing carriage and delivery have to be allowed for A packing case may cost 7s 6d credited in full when returned to maker in good condition and carriage paid back The average prices stated do not comprise fixing which can be obtained from the timesheets and taken as daywork and

Siphon.

which includes joints unions and connections to service overflow, flush ventilating, and soil pipes &c

Closet

	s d	£ s d
Wash down W C pedestal plain white glazed		
	25 0	
	0 2	
	1 0	
	1 0	
	2 0	
	2 0	
joint to connect outgo of closet trap to 4 in lead soil pipe (if bent with 4 lugs for screws 8s 6d)	4 10	
		1 16 0

Seat

	s d	£ s d
1¼ in polished mahogany ring seat with nickel plated brass pillar hinges for fixing to basin lugs or ordinary shaped seat with brass hinges and	13 0	
	1 0	
rounded or curved	8 0	
Add if with polished mahogany 4 in back rail or skirting	2 6	
	7 6	
painted 3 coats or galv per pair (pedestal brackets 15 to 17 in high 4s 6d per pair)	2 6	
Paper box 10 in × 7 in × 6 in of ¾ in polished mahogany with brass screw for fixing (painted deal 2s)	3 6	
		1 18 0

Cistern

	s d	£ s d
3 gals cast iron W W P cistern plain painted including ½ in supply ball valve with fly nut and ... brass over	26 0	
	7 0	
	1 6	
galvanised ditto (extra only)	0 6	
silent filling valve and siphoning tubes	2 0	
Carried forward		3 14 0

Brought forward
Add if with water company a test and ...
2 ft of ¾ in lead overflow pipe fixed at ...
Cast iron cistern brackets, 7 to 12 in ... open pattern, with three screw h... fasten against board or wall painted per pair
Add if galvanised, extra only per pair
6 iron screws for fastening pair of brackets
¾ in. deal board wrot ... 2 ft × 1 ft ... chamfered edges and painted four ... securing brackets against
Brass chain with china pull (galv iron ch... ring pull 6d)
Gunmetal wall guide ring for chain (galv 1s)

Pipe

1¼ in lead flush pipe 5½ or 6 ft long including top offset and bottom bend and brass connection to cistern outlet			
Wiped soldered joint to cistern service connection	2	6	
	2	3	
... each)	0	6	
Add if with rubber buffer to bottom clip	0	3	
			0 11 6
			6 18 0
Fixing forego ng parts about a day and a half or say 13½ hrs plumber and mate a. 1s 1 and 7d			1 0 0
			7 18 0
Add 20 per cent profit &c			1 12 0
Price ... complete			9 10 0

Lavatory Basin, and ... The illustration shows a good type of circular fronted white earthenware lavatory basin, with overflow sinkings for soap, skirting, cast iron frame and brackets hot and cold ... supply valves or taps recessed back for ... wit' ... was ... costs 10s extra Outlet may be 1¼, 1½, or 2 in Wash hand basins

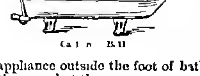
Fig ...

are either priced to include all fittings, or part of them or each is taken separately. The latter method is adopted here for the purpose of analysis

	£	s	d
25 in × 18 in plain white enamelled oval lavatory basin circular fronted with moulded skirting basin only	1	5	0
Cast iron frame and two brackets plain painted	0	5	0
Add if ditto japanned (ditto enamelled 5s)	0	3	0
½ in polished brass screw down h and c pillar supply valves 2 at 5s 6d each	0	11	0
Add if ditto nickel plated 2 at 1s 6d each	0	3	0
1¼ in brass grated washer and brass or rubber plug with fly nut and union	0	4	0
Add if ditto nickel plated	0	1	0
18 in medium weight brass chain with ring stay and nut	0	1	0
Add if ditto nickel plated	0	0	6
1¼ in galv iron P trap with cleaning screw (1¼ in brass ditto 7s 6d)	0	4	0
Price of basin and fittings supplied only	2	17	6
Soldered joint and connection between 1¼ in waste and trap	0	3	0
Fixing basin and parts 4 hrs plumber and mate at 11d and 7d	0	6	0
	3	6	6
Add 20 per cent profit &c	0	13	6
Total price	4	0	0

Cast iron Bath and Fixed —There are many varieties and qualitie ... parts must be carefull ... ld be stated and the ... head, 22 to 25 in ... 18 to 21 in, roll rim 3 to 4 in wide usually round but sometimes flat Taper baths are not so good as parallel ones, where there is a uniform breadth of 22 to 25 in

Fittings are 1½ or 2 in waste either plug and chain or pull up stand waste 1½ or 2 in trap either attached to waste outlet, or a separate adjustable glass enamelled cast iron trap 1¼ or 1½ in over flow and ¾ or 1 in h and c taps upright or globe pattern The smaller sizes are standard These fittings are best combined in one appliance outside the foot of bath, so that nothing will be in the way, but this is more expensive



Cast iron Bath

A first class porcelain enamelled cast iron bath, including

to £10 but the analysis is in Vitreous enamel is cheaper dd polished mahogany top rim skirting, and painted deal sides Cradling and packing 12*s* to 15*s*, refunded by maker on return and if railway paid Extra for carriage, delivery, and hoisting into position, as well as for supply and waste pipes, &c

If necessary, a lead safe or tray to be taken, with outlet and pipe

	£	s	d
Cast iron independent taper bath with 3 in roll rim or edge and detachable cast iron feet and with holes for standard size 1½ in outlet for waste 1¼ in overflow and ¾ in taps			
	4	10	0
	0	10	0
	1	5	0
Set of two corner porcelain enamelled cast iron soap trays at 3*s* 9*d* each	0	7	6
plug and utlet and			
	0	7	0
	0	1	0
1¼ in brass overflow, with plain bent boss (1½ in ditto 3*s* 6*d*)	0	2	6
Add if ditto nickel plated (1½ in ditto 1*s*)	0	1	0
	0	12	0
	0	4	0
waste trap overflow and h and c taps supply pipes &c of polished brass or nickel plated from £5 to £7]			
Price of bath and fittings supplied only	6	0	0
Fixing above parts and connecting to piping 4 hrs plumber and mate at 11*d* and 7*d*	0	6	0
	6	6	0
Add 20 per cent profit &c	1	14	0
Total price	10	0	0

CHAPTER XIX.—ZINCWORKER.

MEMORANDA

Employment of Zinc

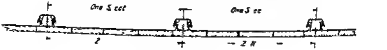
Quality Good zinc is light in colour and economical in first cost for roofing Life about 20 to 25 years then practically worthless Inferior zinc is darke

Gauges		Use
1 to	3	special orders and dimensions
4	6	are used for Packing Cases
8	10	Bending &c
12	15	Baths &c
13	16	Roofs
13	16	Gutters.
13	16	R.W Pipes

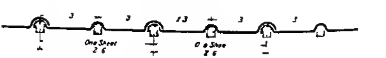
Manufacturers sometimes adopt gauges and weights of their own

Sheets Zinc is rolled in sheets 6 7 8 or 10 ft long and 2 ft 8 in or 3 ft wide Common sizes 7 ft × 3 ft or 8 ft × 3 ft Larger dimensions special order and extra cost

6 ft × 2 ft 8 in or 6 ft × 3 ft Small
7 ft × 2 ft 8 in or 7 ft × 3 ft Common
8 ft × 2 ft 8 in or 8 ft × 3 ft Common
10 ft × 2 ft 8 in or 10 ft × 3 ft Special



Plain roll cap system



Italian corrugated roofing

Allowances —For plain roll and cap system allow —
Square rolls 2 ft 10½ in or 2 ft 11 in, apart c to c

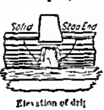
to

For

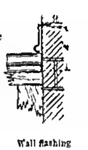
Purlins underneath rafters 7 or 10 ft apart, c to c

Turn down

Section of drip



Elevation of drip



Wall flashing

Roll cap

Square cap

Weight of Zinc

Thickness	Weight per ft. sup	Thickness	Weight per ft. sup
in	lbs	in	lbs
1/64	2 34	9/64	21 09
1/32	4 69	5/32	23 44
3/64	7 03	11/64	25 78
1/16	9 38	3/16	28 13
5/64	11 72	13/64	30 47
3/32	14 06	7/32	32 81
7/64	16 41	15/64	35 16
1/8	18 75	1/4	37 45

1 cubic foot of zinc	449 10 lbs	1 lineal foot 1 in square bar	3 12 lbs
1 circular foot 1 in thick	29 42 lbs	1 lineal foot 1 in round bar	2 45 lbs

Flux and soldering fluid for zinc is chloride of zinc

Zinc Gauges

There are two recognised zinc gauges—*English Zinc Gauge* for general sheet zinc and the *Vieille Montagne Zinc Gauge* used by the Vieille Montagne *Zinc* Mining Co in connection with their roofing sheets

Slight variations sometimes occur in the same nominal gauge

English Zinc Gauge.

(E Z G)

English Zinc Gauge	Nearest Birmingham Wire Gauge.	Thickness English Zinc Gauge	Weight per foot super	7 ft × 3 ft Approx weight per Sheet	7 ft × 3 ft Sheets per 10 cwt Cask	8 ft. × 3 ft. Approx weight per Sheet.	8 ft. × 3 ft. Sheets per 10-cwt Cask
No	No	in	lbs ozs	lbs ozs	No	lbs ozs	No
1	36	004	0 2	2 10	426	3 0	373
2	35	006	0 3¼	4 9	204	5 4	213
3	34	007	0 4¼	5 14	191	6 12	166
4	33	008	0 5	6 9	171	7 8	149
5	31	·010	0 6	7 14	142	9 0	124
6	30	011	0 6$\frac{9}{10}$	9 1	124	10 6	108
7	29	013	0 7¾	10 3	110	11 10	96
8	28	015	0 9	11 13	95	13 8	83
9	27	017	0 10¼	13 7	83	15 6	73
10	25	019	0 11½	15 1	74	17 4	65
11	24	021	0 13¼	17 8	64	20 0	56
12	23	025	0 15¼	19 14	59	22 11	49
13	22	028	1 0¾	22 0	51	25 2	45
14	21	·031	1 2½	24 4	46	27 12	40
15	20	036	1 5¼	28 9	39	32 10	34
16	19	041	1 9	32 13	31	37 8	30
17	18	·046	1 13	38 1	29	43 8	26
18	18	051	1 18	44 10	25	51 0	22
19	17	059	2 4¾	47 5	21	55 2	20
20	16	·065	2 7	51 3	22	58 8	19
21	15	·072	2 6¼	53 8	21	61 2	18

Vieille Montagne Zinc Gauge
(V M G)

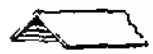
Vieille Montagne Zinc Gauge	Nearest Birmingham Wire Gauge	Thickness Vieille Montagne Zinc Gauge	Weight per foot super	7 ft × 3 ft Approx Weight per Sheet	7 ft × 3 ft Sheets per 10-cwt Cask	8 ft × 3 ft Approx Weight per Sheet	8 ft × 3 ft Sheets per 10-cwt Cask
No	No	in	lbs ozs	lbs ozs	No	lbs ozs	No
1	36	004	0 2¼	3 1	366	3 8	[illegible]
2	35	006	0 3¼	4 4	264	4 14	230
3	34	·007	0 3 3/16	5 2	219	5 14	131
4	33	·008	0 4½	6 5	177	7 3	155
5	31	010	0 5¼	7 7	151	8 8	122
6	30	011	0 6¼	8 12	128	10 0	112
7	29	013	0 7¼	10 3	110	11 10	96
8	28	015	0 8 5/16	11 11	96	13 6	84
9	27	·018	0 10¼	13 9	83	15 8	74
10	25	020	0 11¾	14 15	75	17 2	65
11	24	023	0 13¼	17 8	64	20 0	56
12	23	026	0 15¼	19 14	56	22 11	49
13	22	·029	1 0 3/16	22 3	50	25 6	44
14	21	·032	1 2¾	24 10	45	28 2	40
15	20	·038	1 5¼	28 9	39	32 10	34
16	19	·043	1 8¼	32 8	34	37 2	30
17	18	·048	1 11¼	36 5	31	41 8	27
18	18	053	1 14¼	40 4	28	46 0	24
19	17	058	2 1¼	44 3	25	50 8	22
20	16	063	2 4¼	48 2	23	55 0	20
21	15	070	2 8¾	54 7	21	61 2	18
22	14	077	2 12¼	58 13	19	67 3	17
23	14	·084	3 1	64 5	17	73 8	16
24	13	·091	3 5¼	69 13	16	79 13	14
25	13	·098	3 9¼	75 4	15	85 0	13
26	12	105	3 13¼	80 3	14	92 2	12

Zinc Roofings

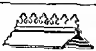
Weight per square including corrugations and laps

Description	13 Gauge	14 Gauge	15 Gauge	16 Gauge
	lbs	lbs	lbs	lbs
Square roll cap	130	144	160	[illegible]
Ordinary corrugation	136	150	175	[illegible]
Italian corrugation	136	150	175	[illegible]

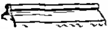
Zinc ridging Nos 13 to 16 gauge in 7 or 8 ft lengths, and 6, 9 12 15 or 18 in girth



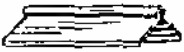
Plain ridging



Ornamental ridging



Scalloped ridging



Roll ridging

Zinc Nails.

Description	1 in	$1\frac{1}{4}$ in	$1\frac{1}{2}$ in	$1\frac{3}{4}$ in	2 in
	No per lb	No per lb	No per lb	No per lb	No per lb
Zinc "Ordinary"	400	280	200	130	90
Zinc "F B	322	256	150	126	92

Perforated Zinc.

Made in stock sheets, 8 ft × 3 ft, of various gauges
Holes of different diameters and pattern arrangement

Zinc Sparge Pipes.

$\frac{3}{4}$ in diam, of No 14 gauge, or $18\frac{3}{4}$ ozs per ft sup, zinc, perforated

Zinc Pipes

For $1\frac{1}{2}$ in pipes use No 12 gauge, or $15\frac{1}{4}$ ozs per ft sup, zinc
" 2 in " " No 14 " " $18\frac{3}{4}$ ozs " "
" 3 in " " No 16 " " $24\frac{3}{4}$ ozs " "

Zinc Bell Tubing.

$\frac{1}{4}$ in, $\frac{5}{16}$ in, $\frac{3}{8}$ in, $\frac{1}{2}$ in, $\frac{5}{8}$ in, $\frac{3}{4}$ in, $\frac{7}{8}$ in, 1 in in 7 or 8 ft lengths
Usually split but can be supplied with soldered joints

Materials and Labour Fixing

Zinc laid complete in Flats or Gutters the rolls and laps to be added to the superficial measurement V M Gauge

For 25 ft sup	No 13 gauge or $16\frac{3}{8}$ ozs	No 14 gauge, or $18\frac{3}{4}$ ozs	No 15 gauge or $21\frac{1}{2}$ ozs	No 16 gauge or $24\frac{3}{4}$ ozs
Sheet zinc, lbs ...	26 40	29 30	34 00	38 70
Clout nails, lbs	25	25	25	25
Zincworker and labourer, hrs	3 25	3 50	3·75	4 00
25)				
Per ft sup				

5 in Half round zinc Eavesgutters including brackets and fixing —

For 10 ft run	No 13 gauge or 16 ozs	No 14 gauge or 18 ozs.	No 15 gauge or 21 ozs.	No 16 gauge or 24 ozs
Zinc lbs	7 00	8 00	9 00	10 00
3 W I brackets lbs	2 00	2 00	2 00	2 00
Zincworker and labourer hrs	2 25	2 50	2 75	3 00
10)				
Per ft run				

3 in Zinc Rainwater Pipes including holdfasts and fixing —

For 10 ft run	No 13 gauge or 16 ozs	No 14 gauge or 18 ozs	No 15 gauge or 21 ozs	No 16 gauge or 24 ozs.
Zinc lbs	8 30	9 20	10 70	12 20
Solder lbs	40	40	40	40
Coals cwt	01	01	01	01
2 W I holdfasts lbs	1·00	1·00	1·00	1 00
Zincworker and labourer hrs	2 50	2 75	3 00	3 25
10)				
Per ft run				

¾ in. Perforated zinc Sparge Pipe and fixing —

For 10 ft run	No 14 gauge or 18 ozs
Zinc lbs.	2 50
Solder lbs	35
Coals cwt	·01
Zincworker and labourer hrs	3 50
10)	
Per ft run	

Pewter and Fixing

= 25 ft sup

For ft sup	
Pewter 25 × 3½ lbs.	87 50
Copper clout nails lbs	50
Coals cwt	07
Zincworker and labourer hrs	16 00
25)	
Per ft sup	

Pewterer's Solder

1 part lead 1 part bismuth and 2 parts tin
Melting point 201 Fah 1 lux gall poli oil

PRICES

Roofing

All metal laid to be measured on the girt. Vieille Montagne gauge

Description		No 13 Gauge s	d	No 14 Gauge s	d	No 15 Gauge s	d	No. 16 Gauge s	d
Zinc laid complete on flat roofs, &c, including zinc rolls, laps, clips, ends, ridging, labour and everything necessary	per f s	0	8	0	8½	0	9	0	9½
Add if laid on conical roofs and turrets		0	0½	0	0¾	0	1	0	1¼
Add to both items if corrugated		0	1½	0	2	0	2½	0	3
if curved		0	1	0	1½	0	2	0	2½
if in square roof gutters		0	1½	0	2	0	2½	0	3
if in aprons or flashings		0	0½	0	0½	0	0¾	0	0¾
Add for timber work in zinc corrugated roofs		0	5	0	6	0	7	0	8
Zinc in plain or Italian verandahs		0	9½	0	10	0	10½	0	11
Carter & Son's improved non-solder roofing for flats, measured as laid		0	5	0	5½	0	6	0	6½
Add extra for gutters in ditto		0	0½	0	0½	0	0¾	0	1
Italian corrugated roof		0	0½	0	0½	0	0¾	0	1
Labour only laying flat roofs, gutters, &c		0	2¼	0	2½	0	2¾	0	3
Labour only laying conical roofs and turrets		0	2½	0	3½	0	3½	0	4½
Stripping zinc from roofs, flats, gutters, flashings, verandahs, &c, and removing to store		0	0¾	0	1	0	1¼	0	1½
1½, 1¾ or 2 in round or square zinc roll capping, sold in 7 or 8 ft lengths, supplied only	per f r	0	2½	0	3	0	3½	0	4
Zinc ridge or hip roll 18 in girth, including galvanised screws and fixing		1	3	1	6	1	9	2	0
Solid ends or shields to zinc roll capping	each	0	2½	0	3	0	3½	0	4
Extra material and labour to zinc cesspools		1	0	1	3	1	6	1	9

Gutters and Rainwater Pipes.

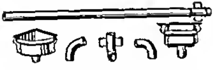
Made of stout zinc, 15 or 16 gauge, including fixing
Sold in 7 or 8 ft lengths

Description		2 in	2½ in	3 in	3½ in	4 in	4½ in	5 in	6 in
GUTTERS		s d	s d	s d	s d	s d	s d	s d	s d

Description		2 in	2½ in	3 in	3½ in	4 in	4½ in	5 in	6 in
Half round zinc gutters including iron brackets fixed 3 ft apart	per f r	0 4	0 5	0 6	0 7	0 8	0 9	0 10	1 0
Angles for ditto	each	0 10	1 0	1 2	1 4	1 6	1 8	1 10	[illegible] 2
Outlets for ditto	„	0 5	0 6	0 7	0 8	0 9	0 10	0 11	1 1
Stopped ends for ditto	„	0 4	0 5	0 6	0 7	0 8	0 9	0 10	1 0

Description		2 in	2½ in	3 in	3½ in	4 in	4½ in	5 in	6 in
O G or moulded zinc gutters including iron brackets 3 ft apart	per f r	0 6	0 7	[illegible] 8	0 9	0 10	0 11	1 0	1 2
Angles for ditto	each	1 0	1 2	1 4	1 6	1 8	1 10	2 0	2 4
Outlets for ditto		0 6	0 7	[illegible] 8	0 9	0 10	0 11	1 0	1 2
Stopped ends for ditto		0 5	0 6	[illegible] 7	0 8	0 9	0 10	0 11	1 1

R W Pipes



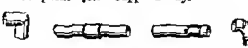
Description		2 in	2½ in	3 in	3½ in	4 in	4½ in	5 in	6 in
Round zinc rainwater pipes, lap folded and fixed with ears &c	per f r	0 7	0 8	0 9	0 10	0 11	1 0	1 1	1 3
Square heads	each	3 0	3 6	4 0	4 6	5 0	5 6	6 6	8 0
Bell heads	„	3 3	3 9	4 3	4 9	5 3	5 9	6 9	8 3
O G heads		3 6	4 0	4 6	5 0	5 6	6 0	7 0	8 6
Octagon heads		5 0	5 6	6 0	6 6	7 0	7 6	8 6	10 0
Swan necks 3 in projection		2 6	2 9	3 0	3 3	3 6	3 9	4 3	5 0
„ „ 6 in		2 9	3 0	3 3	3 6	3 9	4 0	4 6	5 3
„ „ 9 in		3 0	3 3	3 6	3 9	4 0	4 3	4 9	5 6
„ „ 12 in		3 6	3 9	4 0	4 3	4 6	4 9	5 3	[illegible] 0
Bends and elbows		1 6	1 9	2 0	2 3	2 6	2 9	3 3	4 0
Shoes		1 3	2 0	2 3	2 6	2 9	3 0	3 6	4 3
Taking down gutters and pipes and removing to store	per f r	0 1	0 1	0 1	0 1	0 1½	0 1½	0 1½	0 1½

Sparge Pipes

		s	d
¾ in perforated zinc sparge pipes No 14 gauge soldered and fixed	per ft	0	9
Fixing only solder fuel, and labour		0	7

Ventilating Pipes

Stout zinc ventilating pipes and bends with airtight soldered socket projecting 4 in for packed joint supplied only.



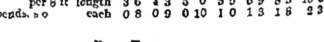
Elbow   Pipe with joint.   Cleaning door   Bend.

	2 in	2½ in	3 in	3½ in	4 in	5 in	6 in
	s d	s d	s d	s d	s d	s d	s d
Piping supplied only per 8 ft length	3 6	4 3	5 0	5 9	6 9	8 3	10 0
Stamped bends, s o each	0 8	0 9	0 10	1 0	1 3	1 8	2 3

Zinc Tubing

	¼ in	⅜ in	½ in	⅝ in	¾ in	⅞ in	1 in
	s d	s d	s d	s d	s d	s d	s d
Zinc bell tubing supplied only per 8 ft length	0 6	0 7	0 8	0 10	1 0	1 3	1 6
Airtight tubes with ferrules s o per 8 ft length	—	—	0 9	0 11	1 1	1 4	1 7
Obtuse angles s o each	—	—	0 6	0 7	0 8	0 9	0 10
Round elbows s o	—	—	0 6	0 7	0 8	0 9	0 10
Siphons s o	—	—	1 2	1 4	1 6	1 8	1 10

Zinc Frets



Width	¾ in	1½ in	2¼ in	2½ in	2¾ in	3½ in	4½ in
	s d	s d	s d	s d	s d	s d	s d
Zinc fret work supplied only per 8 ft length	0 11	1 2	1 6	1 8	1 10	2 2	2 6

Stamped Zinc Mouldings

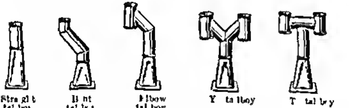
Width	[illegible]	2½ in	3 in	3½ in	4 in	4½ in	5 in
	s d	s d	s d	s d	s d	s d	s d
Various ornamental patterns s o per yd run	1 6	1 8	1 10	2 0	2 3	2 6	3 0

Zinc Stove Pipes Flues and Cowls

Malt house " Lobster back, d Smoke pers r Vert cal or grinder " W nd guard Brighton Helmet. Lou re

	4 in s d	6 in. s d	9 in s d	10 in s d	11 i s d	1° in s d	14 in s d
Stove pipes supplied only per f r	1 0	1 6	2 3	2 6	2 9	3 0	3 6
Flue pipes	1 1	1 7	2 4	2 7	2 10	3 1	3 6
Common cowls each	4 6	5 0	5 6	6 0	6 6	7 0	8 0
Malt house	6 6	7 0	7 9	8 3	8 9	9 3	10 3
Lobster back	6 0	6 6	7 3	7 9	8 3	9 0	10 0
Smokedispersers	6 6	7 0	7 9	8 °	8 9	9 3	10 3
Vert cal or grinder cowls s o	4 0	4 6	5 3	5 9	6 3	7 0	8 0
Wind guards common	10 0	11 6	13 6	15 0	16 6	18 0	21 0
Brighton cowls s o	8 0	9 0	10 6	11 6	12 6	14 0	17 0

Zinc Tallboys



Stra gl t tal boy B nt tal by Elbow tal boy Y ta lboy T tal by

	4 ft s d	ft s d	ft s d	7 ft s d	8 ft s d
10 in pipe No 15 gauge for ordinary chimneys s o each	18 0	20 0	22 0	25 0	28 0
10 in pipe No 16 gauge for ordinary chimneys s o	20 0	22 0	21 0	27 0	30 0
11½ in pipe No 15 gauge for kitchen ch mneys, s o	23 0	.5 0	8 0	3? 0	36 0
11½ in p pe No 16 gauge for kitchen chimneys s o	25 0	27 0	30 0	31 0	38 0

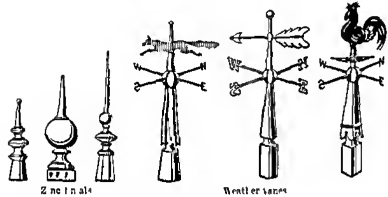
Metal Lights

		s d.
		1 8
		2 0
		2 9
		3 0
If with vent lators bala ce ight l n a l pull		2 1
Zi c strip bars skyl ghts extra	per f r	1 0
Zinc l p bars extra		1 6
Casements to open in l ght or centre with l i es and pulleys extra	each	1 0

Zinc Bars.

	s	d			s	d
Zinc tee bar $\frac{1}{2}$ in on face s o per 8ft length	1	4	=	per f r	0	2
$\frac{3}{4}$ in ditto ditto ,,	2	0	=		0	3
Zinc sash bar $\frac{1}{2}$ in. ditto ditto	1	4	=		0	2
$\frac{9}{16}$ in ditto ditto	1	8	=		0	$2\frac{1}{2}$
Zinc angle bar $\frac{1}{2}$ in × $\frac{1}{2}$ in ditto ditto	1	8	=		0	$2\frac{1}{2}$
$\frac{3}{4}$ in × $\frac{3}{4}$ in ditto ditto	2	4	=		0	$3\frac{1}{2}$

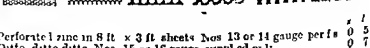
Zinc Finials and Vanes



Zinc finials — Weather vanes

		s	d
Zinc finials with mouldings ball and spike s o 1 ft 8 in high	each	10	6
Ditto ditto 2 ft 1 in ,,		13	6
Ditto ditto 2 ft 6 in		16	0
Zinc weather vanes mounted on hardened steel spindles and evenly balanced $3\frac{1}{2}$ 4 or $4\frac{1}{2}$ ft high bases made to fit tightly on 4 in pole with points of compass below and arrow above s o		25	0
Ditto ditto ditto with flat fox above s o		50	0
Ditto ditto ditto with flat cock above s o		55	0

Perforated Zinc



	s	d
Perforated zinc in 8 ft × 3 ft sheets Nos 13 or 14 gauge per f s	0	5
Ditto ditto ditto Nos 15 or 16 gauge supplied only	0	7

PERFORATED ZINC—*continued*

		s	d
[illegible]	per f s	0	3
[illegible]		0	4
[illegible]		2	4
[illegible]	„	0	6
[illegible]	„	0	6
[illegible]	„	1	0

PEWTER

		s	d
Polished sheet pewter 3½ lbs per f s fixed on counter tops with copper nails including burnt joints and dressing *round edges*	per f s	8	6
Add to ditto if fixed in repairs		1	6
Extra labour to *rounded edge* 1½ in girt	per f r	0	5
moulded edge		1	9
Polished sheet pewter when taken by weight s o	per lb	1	7

MATERIALS

(WITHOUT PROFIT)

April 1912	per ton £	s	d	per cwt £	s	d		per lb s	d
Sheet zinc Vieille Montagne in casks of 10 cwt	33	10	0	1	13	6	=	0	[illegible]
Silesian ditto	35	5	0	1	15	3	=	0	[illegible]
Spelter Silesian ditto	25	5	0	1	5	3		0	[illegible]
Tin Straits ditto	193	10	0	9	13	6		1	[illegible]
English Ingots ditto	200	10	0	10	0	6	=	1	[illegible]
Australian ditto	196	0	0	9	16	0	=	1	[illegible]
Bars ditto	201	10	0 =	10	1	6	=	1	[illegible]

		s	d
Plain sheet zinc cut to order No 13 gauge	per f s	0	4
14		0	4½
15		0	[illegible]
16		0	[illegible]
Solder plumber's (1 tin to 2 lead)	per lb	0	8
tinman's (2 to 1)		1	0
fine or soft (1 to 1)		1	1
pewterer's (2 tin 1 lead and 1 bismuth)		1	4
Zinc nails	„	0	6
Zinc tacks	„	0	9
Pipe hooks (4s 6d per gross)		0	4
Zinc tubing		0	[illegible]
Zinc astragals		0	[illegible]
Zinc fret work	„	0	9

WAGES

		s	d
Wages, zincworker's	per hour	0	11
„ zincworker's labourer	„	0	7

ANALYSIS

Sale.—Little zinc is worked in this country, but sheets are mainly supplied by Continental rollers, who have the advantage of forwarding their goods to the provinces under preferential through rates. Sheet zinc is sold in ½ ton casks at per ' ' ' ' ' ' - small lots ' n'tains iron it differ materially according to the character of the work, the quantity and the site. A tracing of the roof to be covered should be sent to a firm of specialists for a tender, as they will do it better and cheaper than the contractor with his ordinary workmen.

No. 15 *gauge Zinc and Laid complete on Flats and Roofs*.—This is taken by the foot super, allowances being made for rolls, turns, laps, welts, passings, &c., and as much as 40 per cent may be added for these to the measurement as laid on a plain flat. Everything is included except soldered shields to ends of rolls which are numbered. Distances apart of rolls and drips are arranged to suit size of sheets. For details see Memoranda. If sheets are corrugated measure by the superficial foot as for plain without allowing for the corrugations and state it. For the roll and cap system the Vieille Montagne Co.'s mode of laying is most favoured as carried out by F. Braby & Co., London. No soldering is allowed. The wooden ' rolls (invariably square) are valued under *Carpenter*.

Fold or we... Cross sect on Longitudinal section

The price of Vieille Montagne sheet zinc is £33 10*s* per ton = 33*s* 6*d* per cwt = 3¼*d* per lb (April, 1912). As No. 15 V.M. gauge weighs 1 lb 5¾ ozs per f.s., it follows that the rate per unit would be—3¼*d* × 1 lb 5¾ ozs = 4¾*d* per foot sup net. Analysing 25 ft sup as a convenient area we get 34 lbs zinc, ¼ lb nails (if any required) and 3¾ hrs labour. See Memoranda. Allow 10 per cent waste in cutting.

R W P.

	s.	d.
10 lbs. No. [illegible] lb sheet zinc at 3½d per lb. — —	[illegible]	[illegible]
¼ lb tinman's solder at 1s. per lb — — —	0	4
1/1 cwt. say 1 lb. coal for fuel at 20s. per ton —	0	[illegible]
2 sheets zinc ear [illegible] at 1d. — —	0	[illegible]
2 W. I. B. [illegible] at [illegible] per dozen — —	0	1
3 hrs. zincworker and labourer at 11d. and 7d. —	4	6
	[illegible]	[illegible]
Add 20 per cent. profit &c. — — — —	1	[illegible]
Price per 10 ft. run — — —	1[illegible] [illegible]	11½
Price per ft. run — — —	1	0

Mechanic's price would be much less, and the omission of the sol[illegible] [illegible] ears, and [illegible] with consequent less labour would reduce the cost to as low as [illegible] 9d.

¾ in. *Perforated Zinc Spray Pipe, and Fixing.*—Usually No 14 gauge or 10½ ozs. per f.s. 10 ft. run would need 21 lbs. zinc, ¾ lb solder, fuel, and 3½ hrs. labour for perforating the spray holes as well as for fixing. See Memoranda.

	s.	d.
[illegible] lbs. No 14 gauge zinc at 3½d per lb. — —	0	[illegible]
¾ lb tinman's solder at 1s. per lb. — — —	0	4
1/01 cwt. say 1 lb. coal for fuel at 20s. per ton —	0	0¼
3½ hrs. zincworker and labourer at 11d. and 7d. —	5	3
	6	4
Add 20 per cent. profit &c. — — —	1	3
Price per 10 ft. run —	10)[illegible]	[illegible]
Price per foot run — — —	0	[illegible]

Polished sheet Pewter, and fixed on Counter.—A suitable weight for counter tops is 3½ lbs. per f.s., dressed round corners and edges and fixed with copper nails 3 lbs. per thousand. For 25 ft. sup. × 3½ lbs. take 87½ lbs. pewter ¼ lb copper nails, fuel for burnt joints, and 16 hrs labour See Memoranda.

	s.	d.
87½ lbs. sheet pewter at 1s. 7d. per lb.	13[illegible]	6½
Waste in cutting, 10 per cent — — —	13	10
¼ lb copper clout nails at 1s. 3d. per lb. — — —	0	[illegible]
1/07 cwt. say 8 lbs. coal at 20s. per ton —	0	1
16 hrs. zincworker and labourer at 11d. and 7d.	24	0
	1[illegible]	1
Add 20 per cent. profit &c.	35	5
Price per 25 ft. sup —	25)212	6
Price per foot super	8	6

CHAPTER XX.—PLASTERER.

MEMORANDA

Lime

100 tons of blue lias lime yield [illegible] tons of quicklime 1,592 bushels of ground lime and 3063 bushels of slaked lime, 74 gallons of water are required for slaking 1 ton of quicklime

Stone Lime		Lias Lime	
1 trade bushel	= 70 lbs.	1 trade bushel	= 75 lbs
2 " "	= 1 bag	2 " "	= 1 bag
16 " "	= 1 yd. cube	30 " "	= 1 ton
8 bags "	= 1 yd. cube	10 bags	= 1 ton
2 yards cube	= 1 ton	1½ yards cube	= 1 ton

[illegible]

Sand

1 yard cube of coarse dry sand	= 21 cwt
1 " wet	= 29 cwt
1 sand	1 single load
1	= 21 striked bushels
1 bushel of coarse dry sand	= 128 lbs
1 " " wet	= 151 lbs
22 feet cube of coarse dry sand	1 ton
19 wet	= 1 ton

Hair

A bushel of dry hair weighs about 14 lbs, and 1 ft cube 11 lbs It is classed according to quality as Nos 1, 2, and 3, the latter being the best Sold in bags of ¼, ½ and 1 cwt each

Add 1 lb of hair to every 2 ft cube of coarse stuff for good work

Add 1 lb of hair to every 3 ft cube of coarse stuff for ordinary work

Laths

A bundle contains 360 to 500 ft according to length of lath

The lengths vary from 3 ft to 5 ft, increasing 6 in at a time

The number of laths in a bundle therefore varies They are spaced about ⅜ in apart 30 bundles = 1 load

Single fir laths are 1 in broad × $\frac{1}{8}$ in to $\frac{3}{16}$ in thick
Lath and half laths are 1 in broad × $\frac{3}{16}$ in to $\frac{1}{4}$ in thick
Double laths are 1 in broad × $\frac{1}{4}$ in to $\frac{3}{8}$ in thick
1 yard super requires 21 laths, each 3 ft long
" " 21 " " 3 ft 6 in long

Nails

Lath nails are either wrought, cut, or cast. The latter, being cheapest, are most often used For good work they should be galvanised, or of zinc, or be French wire nails

Single lath nails are $\frac{3}{4}$ in long and 950 weigh 1 lb
Lath and half nails are $\frac{7}{8}$ in long, and 850 weigh 1 lb
Double lath nails are 1 in long, and 750 weigh 1 lb

Portland Cement

1 bushel of Portland cement			= 112 lbs
2 bushels	"	"	= 1 bag
1 bag net	"	"	= $2\frac{1}{4}$ ft cube
1 " "	"	"	= 2 cwt
10 bags	"	"	= 1 ton
1 ft cube	"	"	= 87 lbs
1 cental, London custom			= 100 lbs
1 bag, net	"	"	= 200 lbs
1 " "	"	"	= 2 centals
11 bags	"	"	= 1 ton
1 yd cube	"	"	= 2350 lbs
1 cask, or 4 centals net			= 400 lbs

Plaster of Paris

1 bag of plaster of Paris			= 14 lbs
1 sack	"	"	= 2 cwt
1 "	"	"	= 3 bushels
1 bushel	"	"	= 75 lbs
1 cask	"	"	= $2\frac{1}{4}$ cwt
10 sacks	"	"	= 1 ton

Roman Cement.

1 bushel of Roman cement			= 78 lbs
3 bushels	"	"	= 1 sack
5 "	"	"	= 1 cask
1 cask	"	"	= $3\frac{1}{2}$ cwt
1 ft cube	"	"	= 60 lbs

1 bushel of Roman cement neat will cover $1\frac{1}{4}$ sq yds, $\frac{3}{4}$ in thick
1 " " " and 1 sand " $4\frac{1}{2}$ " $\frac{1}{2}$ in "

Parian Cement

1 bushel of Parian cement			= 75 lbs
3 bushels	"	"	= 1 sack
1 sack	"	"	= 2 cwt
1 cask	"	"	= $2\frac{1}{4}$ cwt
1 "	"	"	= 4 bushels
1 "	"	"	= $1\frac{1}{4}$ sacks

Keen's Cement.

1 bushel of	Keen's	cement	= 75 lbs
3 bushels	"	"	= 1 sack.
1 sack	"	"	= 2 cwt
1 cask	"	"	= $2\frac{1}{2}$ cwt
1 "	"	"	= 4 bushels
1 "	"	"	= $1\frac{1}{4}$ sacks

1 cwt Keen's cement, neat will cover about 10 yards super 1 cwt Keen's cement and 2 cwts sand will cover 15 yards super $\frac{1}{4}$ in thick

4 bushels of Keen's or Parian cement and 4 bushels of sand will cover 10 yards super $\frac{1}{2}$ in thick Allow 12 gals water and 6 hours labour

Miscellaneous

1 cwt of Martin's cement neat will cover 3 yards super $\frac{1}{2}$ in thick

1 cwt of Martin's cement with 1 cwt sand will cover 6 yards super $\frac{1}{2}$ in thick

1 bushel of selenitic lime	= 62 lbs
1 sack " "	= 132 lbs
17 sacks " "	= 1 ton
About two hods of plaster	= 1 bushel
1 firkin of double size	= 48 lbs
2 dozen of whiting	= 1 cwt
1 cubic yard of coarse stuff	= 1 load

[illegible]

Proportions of Materials for Plastering

Description of Work	Lime	Sand	Hair	Water	Laths	Nails	[illegible]
To cover 100 yds super —	yds cube	yds cube	lbs	gal	bdls	lbs	hrs
Rendering 1 coat ($\frac{3}{4}$ in)	1	2	16	100			[illegible]
Render 1 coat, and set with fine stuff ($\frac{3}{4}$ in)	2	2	25	200			[illegible]
Render, float and set with fine stuff ($\frac{3}{4}$ in)	$2\frac{1}{2}$	$2\frac{1}{2}$	30	250	—		[illegible]
Lath and plaster, 1 coat	1	2	16	100	22	14	25
Lath, plaster and set	2	2	23	220	22	14	42
Lath, plaster float and set	$2\frac{1}{2}$	$2\frac{1}{2}$	32	270	22	14	67
To cover $4\frac{1}{2}$ yds super							
Lathing only, lath and half	—		—	—	1	$\frac{1}{2}$	1

Proportions of Materials for Plastering—*continued*

$\frac{1}{10}$ ft cube unslaked lime $\frac{1}{33}$ ft cube plaster of Paris 1 gallon of water	will cover 1 yard super setting with putty and plaster

Portland Cement

Proportion of Materials	½ in	⅝ in	¾ in	⅞ in	1 in
	yds super	yds super	yds super	yds super	yd super
1 bus of cement neat covers	2 8	2 4	2 1	1 7	1 4
1 ditto to 1 bus ($\frac{1}{27}$ yd cube) of sand	4 4	3 8	3 3	2 7	2 2
1 ditto to 2 ditto ($\frac{2}{27}$ yd cube) of sand	6 4	5 6	4 8	4 0	3 2
1 ditto to 3 ditto ($\frac{1}{27}$ yd cube) of sand	8 6	7 5	6 4	5 4	4 3
1 ditto to 4 ditto ($\frac{4}{27}$ yd cube) of sand	10 8	9 7	8 7	7 0	5 4
1 ditto to 5 ditto ($\frac{5}{27}$ yd cube) of sand	13 4	11 7	10 0	8 3	6 7

Robinson's Cement

1 cwt of neat cement = 1⅓ striked imperial bushels

1		covers 15 yards super	¼ in	thick
1	cement and 1 sand	" 7	½ in	"
1	" 2 "	" 11	" ½ in	"
1	" " 3 "	" 15	" ½ in	"

1 cwt mastic 1 gal oil	will cover 5 yards super ¼ in thick " 2½ " ½ in "

Limewhiting and Colouring

Description of Work	Lime	Water	Tallow	Whiting	Blue-black	Glue or Size	Ochre or Copperas	Umber	Prussian Blue	Labour, Plasterer and 1 Labourer
To cover 100 yds super —	bsh	gal	lb	lb	lb	lb	lb	lb	lb	hrs
Limewhite 1 coat	1	10	¾	—	—	or	—	—	—	10
2 coats	1½	17	1¼	—	—	gal	—	—	—	6
Whitening with whiting and size 1 coat	—	10	—	12	½	1¾	—	—	—	7
Ditto 2 coats	—	17	—	21	¾	2¼	—	—	—	12
Colouring in distemper stone or buff 1 coat	—	10	—	10	—	2	3	½	—	8
Ditto ditto 2 coats	—	17	—	21	—	3	5	¾	—	13
Ditto French grey 1 coat	—	10	—	12	—	2	—	—	1½	8
Ditto ditto 2 coats	—	17	—	21	—	3	—	—	2¼	13

Rough Casting or Pebble Dashing

Description of Work (Proportion 1 to 2) ¾ in thick	Lime or Cement	Sand	Hair	¾ in Gravel	Copperas	Cow Manure	Red Oxide	Lampblack	Plasterer and Labourer
To cover 100 yds —	bsh	yds cube	lbs	yds cube	lb	lb	lb	lb	hrs
Rough casting 2 coats	20	2	16	¾	—	—	—	—	15
Ditto, coloured buff	20	2	16	¾	5	1	—	—	16
Ditto do terracotta	20	2	16	¾	5	—	11	4	16
Ditto, do black	20	2	16	¾	—	—	—	5	16

PRICES

Rendering with Haired Mortar

		Straight s	d	Curved s	d
Rendering 1 coat	per yd sup	0	10½	1	0
" and set with fine stuff		1	2	1	4
" 2 coats		1	3	1	6
Render and float		1	2	1	5
Render, float, and set with fine stuff		1	6½	1	8
" with putty and plaster		1	8	1	10
Add if the rough coats are gauged for each coat		0	3	0	3

Lathing and Plastering

		s	d	s	d
Lathing only, lath and half	per yd sup	1	0	1	3
Lath and plaster 1 coat		1	10½	2	1
" plaster, and set with fine stuff		2	1	2	4
" " putty and plaster		2	6	2	9
" and plaster, 2 coats and set with fine stuff		2	4	2	7
Ditto, set with putty and plaster		2	7	2	11
Lath plaster and float		2	2	2	5
" set with fine stuff		2	6	2	9
" putty and plaster		2	8	2	11
Add if double fir laths are used		0	3	0	4
Add if the rough coats are gauged for each coat		0	2	0	2

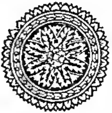
Rendering with Portland Cement

		s	d	s	d
Render with pure Portland cement ½ in thick	per yd sup	1	10	2	3
Render and float ¾ in thick with 1 cement to 1 sand		2	3½	2	8
Ditto, ditto 1 cement to 2 sand		1	11½	2	5
Ditto ditto 1 cement to 3 sand		1	8½	2	1
Add if trowelled to a smooth surface		0	6	0	8
Add if jointed in imitation of stone		0	3	0	4
Portland cement wash per coat		0	2	0	2

0 0 2

Fpiezes Cornices Mouldings &c in Plaster

Egg and Dart.



Centre Piece

Bracket

Hon ys ckle

		Straight s	Straight d	Curved s	Curved d
Lath plaster float and set friezes and soffits	per ft sup	0	8	0	11
Ditto panelled and moulded		1	1	1	4
Render float and set friezes and soffits		0	[illegible]	0	10
D		0	11	1	5
		0	4	1	2
		1	1	1	6
	r ft run	0	3	0	4
in roll		0	5	0	[illegible]
Arris		0	0¾	0	1
Quirk		0	1	0	1½
Bead and quirk under 2 in girth		0	1½	0	
double quirk ditto		0	2	0	3
Staff bead 1½ in to 3 in girth and double quirk		0	3	0	4
Stops and mitres to quirks	each	0	1	0	1
to bead and quirk		0	1½	0	1½
and double quirk		0	2	0	2
to staff bead and double quirk		0	3	0	3

Stops and mitres are priced at the value of 1 foot run of the corn ce mould ng or bead &c

Cornices Mouldings Skirtings &c, in Portland Cement

		Straight s	Straight d	Curved s	Curved d
Plain cornices and mouldings above 9 in girth	per ft sup	1	0	1	4
Ditto 6 in to 9 in ditto	per ft run	0	9	1	0
under 6 in		0	[illegible]	0	10
O		0	5	0	8
		0	5½	0	8
		0	9	1	0
		0	4½	0	[illegible]
		0	6¼	0	[illegible]
Moulded architraves 6 in		0	9	1	0
Arris		0	2	0	3
Quirk		0	1½	0	2
Flush bead in cement dado		0	2	0	3
Staff bead 1½ in to 3 in girth and double quirk		0	5	0	6

Calculate stops and mitres as before

Parian or [illegible]

(On [illegible]

Render and float 1 [illegible] per [illegible]
Trowel and set face of wa[illegible]
Ditto ditto, panelled [illegible]
splayed per [illegible]
Plain mouldings over 6 in g[illegible]
Moulded skirting includ[illegible]
Trowel and set margins 3 in [illegible]
under per [illegible]
Arris
Chamfer 3 in wide per [illegible]
Rounded angle 4 in girth
Bead and quirk under 1½ in girth
double quirk ditto
Flush and staff bead 1½ to [illegible] in girth
and double quirk
Stops and mitres are w[illegible]rth [illegible]

Stucco

Bastard stucco on brick per [illegible]
on lath
Trowelled stucco on brick
on lath
on jambs and [illegible] per ft [illegible]
Reveals 4½ in per ft [illegible]
9 in
Arris edges
Quirk single
Bead single
Bead and double quirk

Martin's Cement

Rendered on brick per [illegible]
Trowelled for painting
Render float and set on lath
Mouldings 1[illegible] to 18 in girth per ft [illegible]
Narrow margins or 4 in reveals per ft [illegible]
Plain skirting 9 in high

Limewhiting and Colouring

Cleaning or brooming down per [illegible]
Scraping plastered walls and ceilings
Wash and stop ditto
Limewhite 1 coat on walls
2 coats
If on ceilings or roof timbers add
Whiting with whiting and size 1 coat
2 coats

Limewhiting and Colouring—*continued*

		s	d
Colouring with lime and green copperas for buff 1 coat	per yd sup	0	2
Ditto 2 coats		0	2½
Add if superior colours as blue green grey red etc		0	0½
Colouring in distemper stone or buff 1 coat		0	2½
2 coats		0	3½
French grey 1 coat		0	2½
2 coats		0	4½
Sanitary washable distemper common colours 1 coat		0	3
2 coats		0	4
superior colours 1 coat		0	3½
2 coats		0	5
Clearcolle (or size) 1 coat on plastered walls and ceilings		0	0½
Scrape wash and stop plain cornices		0	3½
Whitening to plain cornices with whiting and size 1 coat		0	2½
2 coats		0	4
Coating external brickwork with solid paraffin and naphtha		0	6
Colouring with Duresco 1 coat general surfaces		0	3½
plain cornices		0	4
2 coats general surfaces		0	4½
plain cornices		0	5½

Centre Pieces

		s	d
Ornamental papier mache centre pieces 12 in diameter and fixed	each	21	0
18 in		37	0
24 in		48	0
30 in		57	0
Scrape wash stop and whiten and size 2 coats 12 in diam		0	8
18 in		0	10
24 in		1	0
30 in		1	2

Miscellaneous

		s	d
Raking out mortar joints of old brickwork washing &c	per yd sup	0	7½
cement		0	11
Taking down old rendering lathing and plastering and		0	4
		0	6
		0	3
		0	5
		0	10
		1	2
		1	0
		1	0
lay		0	[illegible]
Ditto 3 in thick (ditto ditto)		0	11
Chimney openings rendered and set	each	2	0

MATERIALS

(WITHOUT PROFIT)

		s	d
Alum powdered or lump	per lb	0	2
Brushes lime white	each	2	6
stock for colouring		5	6
Cement Keen's coarse	per bushel	3	0
fine		3	6
Parian coarse		3	0
fine		3	6
Portland		1	6
Roman		1	9
Martin's coarse	per cwt	4	6
fine		5	9
Chloride of lime	per lb	0	5
	per cwt	30	0
	per gal	2	6
	per lb	0	3½
	per yd cube	6	6
Green copperas (sulphate of iron)	per lb	0	1
Hair bullocks (11 lbs per f. c.)	per cwt	9	6
Laths split fir single	per bundle	1	9
lath and half		2	3
double		2	10
Lime unslaked ground fine grey chalk Dorking	per yd cube	12	0
	per bushel	0	0
Lime unslaked ground fine white chalk	per bushel	0	7½
Grinding lump lime labour only	per yd cube	1	0
Mastic cement	per cwt	5	0
Mortar stone or grey chalk lime 1 to 3 hand made	per yd cube	16	7
	per ft cube	0	7½
hair	per yd cube	19	6
	per ft cube	0	8½
Portland cement 1 to 2 hand made	per yd cube	26	2
	per ft cube	0	11½
1 to 3	per yd cube	23	9
	per ft cube	0	10½
Nails cut steel for laths	per lb	0	2
wrought wire for laths		0	3
Naphtha spirit	per gal	3	6
Pigments dry blue black	per lb	0	3
ivory black		0	9
lamp black		0	3
blue Prussian		3	0
ultramarine		1	0
green copperas		0	1
ochre yellow or red		0	1½
raw umber Turkey		0	3
Vandyke brown		0	7½
Venetian red		0	2
Plaster of Paris coarse	per cwt	2	6
fine		3	6
Potash American	per lb	0	6
Putty for stopping	per ft cube	0	9

MATERIALS—*continued*

		s	d
Sand pit or river, clean sharp, unwashed	per yd cube	7	0
" " " hand washed	"	13	6
" " " washing labour only	"	1	9
" " " screening	"	0	7
" sea washed and dried	"	7	0
Size, best quality	per lb	0	3
" best extra double (40s per cwt)	"	0	4½
Soda, common crystal (6s per cwt)	"	0	0¾
Sulphate of copper	"	0	5
Tallow, Russian or home melted English		0	5
Victorite cement for plastering No 1 quality (Broad & Co Ltd London)	per cwt	2	6
Ditto No 2 quality	"	1	3
Wax for moulds	per lb	3	6
Whiting best washed in lumps (2s 4d per cwt)	"	0	0¼

WAGES

		s	d
Wages plasterer s	per hour	0	11
" labourer s	"	0	7
" boy s	"	0	4½
" modeller s	"	1	3

ANALYSIS

MATERIALS

Coarse Stuff is a rough mortar, containing 1 part of lime to 2 parts of sand, mixed with hair in the proportion of 1 lb of hair to every 2 c ft of mortar for good work or 1 lb to every 3 c ft for ordinary work Sometimes the hair is specified to be in the proportion of 1 lb of hair to every bushel of unslaked lime

Fine Stuff is pure lime slaked with a small quantity of water, and afterwards diluted to the consistency of cream It is then allowed to harden by evaporation until thick enough for use A small quantity of white sand, and some times white hair, is added

Plasterer s Putty is lime dissolved in water, and then run through a hair sieve It is very similar to fine stuff, but ... thout hair ... of ... ter ... in ... set very quickly For cornices, the putty and plaster are mixed in equal proportions

Lime —The pure (*i e*, rich or fat) limes are generally employed for plastering, because in using hydraulic limes,

minute unslaked particles are apt to get into the work, and to "blow," throwing out bits of plaster and injuring the surface. This pure lime should be run into putty some time before it is required, and the sand that is to be used should be perfectly clean and free from impurities. When converted into lime putty, stone lime increases one fourth in bulk.

Mixing fine stuff or putty would probably need about one fourth more time than mixing lime and hair, and the labour for setting with gauged stuff would be considerably in excess of setting with fine stuff.

For details of purchase refer to *Concretor*.

Sand.—See *Concretor*. Good sand for lime plaster should be hard, sharp, gritty and free from all organic matter. In testing it ought to be rubbed between the hands without soiling them. For coarse stuff and for cement for floating coats it should not be too fine. Fine grained sand is best f

limes

or tidal

damp and discolours paper and paint.

Grains of sand should not be uniform but vary in size and shape like the aggregate for concrete. For coarse stuff a composition of coarse and fine sand is best, as the lime will take more of this mixture without losing its plasticity and

is sometimes adulterated with the short hair of horses. It is generally obtained from plasterers' hair merchants, in a dry state in bags or bundles, but foreign hair is cheaper than English. It should be dry and well beaten before use, but hair fresh from the tanner's yard in a wet state makes the best work, as it is much stronger, and mixes freely. Coarse stuff for first coating on lath work requires more hair than for brick or stonework. When coarse stuff is made in a mill the hair must not be added until the stuff is ground, as excessive grinding weakens it.

A bushel of dry hair weighs about 14 lbs. and 1 ft. cube 11 lbs. It is classed according to quality as Nos. 1, 2 and 3, the latter being the best. Sold in bags of ¼, ½ and 1 cwt.

For Hair Mortar, see *Bricklayer*.

Lathing.—Laths come chiefly from Memel and other Baltic ports. They ought to be free from knots and splits

Those split by hand give the best results, as they rend in a line with the grain of the wood, and are therefore generally stronger, and are not so liable to twist as the machine made ones Machine or sawn laths are superseding hand made ones, but there is no comparison between the two The former look much stronger than they really are, but they are very weak The latter are cloven entirely along with the grain thus guaranteeing the maximum strength and resilience

Cast iron nails are used for common work, wrought nails in high class work Zinc and galvanised iron nails have been introduced to prevent rusting French wire nails are the best and do not break For lath and half they should be $\frac{7}{8}$ in long and 850 weigh 1 lb

As Jhilmil ts 5 ft × ft The

Expanded Metal Lathing

price is 1s per yard super, supplied only Expanded metal lathing has been introduced from America, and is principally used for fireproofing Stock sizes 6 7, and 8 ft long × 2 ft wide The Bostwick patent fireproof metal lathing is also an American invention, and has been employed in England

Portland Cement —For full particulars of purchase, &c, see *Concretor*

Plaster of Paris —This is made from calcined gypsum which is a sulphate of lime It is found in immense quantities in Montmartre, near Paris—hence its name In this country it is found in Derbyshire, Cheshire, Nottingham, Cumberland, and Westmoreland Gypsum is got by blasting, it is then boiled or baked and afterwards ground The finest is called alabaster and is soft, pure in colour, and fragile

When mixed with water to form a paste, plaster of Paris sets very quickly expanding as it sets, and attains its full strength in an hour or two Hence in running cornices &c, lime putty is added In the English trade, plaster of Paris is known simply as ' plaster "

Roman Cement —A hydraulic cement was patented by Mr Parker, of London, in 1796, which he called Roman cement, probably from its dark colour, resembling that of mortar found in Roman buildings It is made from the septaria nodules of the London clay formation found in the Isle of Sheppey The septaria of Harwich also produced a cement of the same nature Roman cement is a good material for rapid setting, and very useful for repairing jobs

It will also receive paint almost as soon as finished, while Portland cement takes several months. Its quick-setting properties necessitate a great amount of skill and attention on the part of the workman, and it must be applied as soon as gauged.

Roman cement weighs 70 lbs to 80 lbs per bushel. It will not carry more than two parts of sand or other aggregate, and it has only one third the strength of Portland. Other varieties of Roman cement are Sheppey, Medina, and Atkinson's cements.

Parian and Keen's Cements.—These cements are somewhat alike in make, and have similar qualities. Parian cement was patented in 1846, and consists of gypsum immersed in a solution of borax, cream of tartar, and water, then calcined and ground. It is so called on account of its likeness to Parian marble. It works more freely than either Keen's or Martin's, and sets quickly and hard. [illegible]

Both cements have quick setting properties, and give a hard, non porous surface, capable of taking a fine polish. They are largely used for indoor work, and can be painted on or papered within a few hours of being finished. There are three qualities of manufacture—coarse, fine, and superfine. The last is quite white. The backing or rendering coat should be formed of Portland cement. The next coat is of Parian or Keen's cement and sand, about ½ in thick, and the finishing coat of neat similar cement.

Martin's Cement.—This was the first white cement of a reliable nature having gypsum for its basis, and was invented in 1834. It is an admixture of potash (pearl ash) and hydrochloric acid with gypsum. The cement is a creamy colour, and sets very hard. It is chiefly used for walls, dadoes, and skirtings, and can be painted on in a few hours. There are three qualities—coarse, fine, and superfine.

Robinson's Cement. This is manufactured from alabaster (sulphate of lime) found in the Inglewood Forest near Carlisle. Cost about 15 per cent above ordinary plastering.

Fibrous Plaster consists of fine plaster of Paris cast in suitable moulds, and laid on canvas backing, which is fixed to a wooden framework. It was patented in 1856 by a French modeller. It is specially used for panelled ceilings, centre flowers, and other surface decorations. Fibrous plaster slabs, ¾ in thick, weigh 2¼ lbs per foot super, and

14 lbs of nails or screws will fix 100 yards super Stock sizes, 3 to 4 ft × 2½ ft

Rendering with Haired Mortar

The statements given by textbooks as to the various quantities of material and amounts of labour required for certain quantities of work are most conflicting In some cases they are certainly wrong, and it is obvious that the authors have simply cribbed from other sources without the slightest effort to ascertain if their amounts &c, are feasible if measures tally with weights, &c, as well as other glaring inconsistencies It will generally be found that Seddon is reliable for quantities of stuff, and Hurst for constants of labour as the figures given by these writers are from actual experience They have, however, been somewhat modified in this chapter according to the author's own observations Very rough or uneven walls will make some difference in the quantity of rendering material (See 'Memoranda' for proportions of stuff &c)

Scaffolding—In plastering allow ¼*d* per yard super for each of the four operations of lath render float, and set for fixing and removing scaffolding for plasterers to work from This equals say 2*s* per cent per 100 yds super for use erection and removal of scaffolding

Rendering one Coat—As it is impracticable to work out an analysis from the minute quantities required for a single square yard it is found advisable to show the stuff and labour necessary for some large area (such as 100 yards) and then divide in order to arrive at a fair calculation for a unit The quantit[illegible] ... = 100 yards super of rende[illegible] ... sions are about equal [illegible] are 1 lime to 2 sand with 1 lb hair per bushel of lime As there are 16 trade bushels of lime per yard cube this gives 16 lbs of hair to the yard cube

	£	s	d
1 yard cube unslaked lime at 12s	0	12	0
[illegible]	1	7	0
[illegible]	0	1	4½
[illegible]	0	0	6
[illegible] labourer 7d)	1	10	0
Use of scaffolding erection and removal	0	2	0
	3	12	10½
Add 20 per cent profit &c	0	14	[illegible]
100)	4	7	5
Price per yard super	0	0	10½

Render, 1 Coat, and set with Fine Stuff —This would be ½ in thick, and the hair would mostly be in the rendering, or, say, 25 lbs in all The detailed cost would be—

	£	s	d
	1	4	0
	1	7	0
	0	2	1½
	0	1	0
7d)	2	0	6
	0	2	0
	4	16	7½
Add 20 per cent. profit &c	0	19	3½
	100)5	15	11
Price per yard super	0	1	2

Render, float, and set with Fine Stuff —The thickness is ¾ in , and the quantities are increased as shown as follows —

	£	s	d
2¼ yards cube unslaked lime at 12s	1	8	0
2¼ „ hand washed sand at 13s 6d	1	11	6
30 lbs hair at 9s 6d per cwt	0	2	6½
Water 250 gals at 1½d per 25 gals	0	1	3
Labour 42 hours at 1s 6d (plasterer 11d labourer 7d)	3	3	0
Use of scaffolding erection and removal	0	2	0
	6	8	3½
Add 20 per cent profit &c	1	5	7½
	100)7	13	11
Price per yard super	0	1	6½

Lathing and Plastering

Of this there are virtually three kinds of work each including the common groundwork of lathing —

One-coat work Lath and plaster 1 coat
Two-coat work Lath plaster and set (with fine stuff plasterer's putty or gauged stuff)
Three-coat work Lath plaster float and set (with fine stuff plasterer's putty or gauged stuff)

Lathing only Lath-and Half —The terms and quantities for lathing are also very indefinite A bundle of laths contains 360 ft to 500 ft run and the lengths vary from 3 ft to 5 ft, increasing 6 in at a time The number in a bundle therefore varies, London style The original lath splitters make up 500 ft in a bundle but the merchants frequently have them remade into bundles of a less quantity The

standard bundle consists of **100** laths, but for every 6 in less than 4 ft in length an additional 10 laths per bundle is allowed For example —

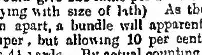
Laths, 3 ft 1 run
3½ ft
4 ft
4½ ft
5 ft

A plasterer generally says **100** laths constitute a bundle, and the quantity differs more in the provinces than in London It is a good thing, when ordering to state the number of feet run expected in a bundle, which is supposed to cover 4¼ yards super

A lath 3 ft long is the most suitable when the joists are the customary 2 in thick and 1 ft apart, centre to centre But if the joists are spaced 1 ft apart in the clear, then laths 3 ft 6 in long are the proper size (See illustrations) Taking 360 ft total in a bundle, with 3 ft as a common

Joists spaced 12 in Centre to Centre

length this would give **120** laths per bundle (the number in a bundle varying with size of lath) As the laths are 1 in wide and ⅜ in apart, a bundle will apparently cover nearly five yards super, but allowing 10 per cent for waste, the real surface is 4¼ yards By actual counting when laths are



Joists spaced 12 in in clear

up the writer has found that 1 yard super requires 24 laths 3 ft long and 21 laths 3 ft. 6 in long The joists being 1 ft apart four nails (one at each joist) per lath will be needed (120 laths × 4 nails), or 480 per bundle As ⅞ in wrought nails would be used for lath and half, and as 850 run to the lb, about ⅝ lb would be required per bundle, allowing for waste Wrought or French wire nails are best, as they do not break

A plasterer and boy can nail 1 yard super of lath and half in $\frac{1}{5}$th hour, or say $4\frac{1}{2}$ to 5 yards per hour. Some plasterers boast that they can put up a bundle of laths in an hour, but this is very exceptional, $\frac{3}{4}$-bundle per hour is a fairer average.

Laths are sold by the lath splitters at 15*s* per thousand, or 1*s* 10*d* per bundle, prime cost. Rail, cartage, &c., will bring this up to 2*s* 3*d*. Lath splitting is a trade in itself, the renders purchasing their wood from timber merchants by the cubic fathom. Of course, laths are also obtained at the sawmills.

	s	*d*
	2	3
	0	2
	1	$3\frac{1}{2}$
	0	1
	3	$9\frac{1}{2}$
Add 20 per cent profit, &c.	0	9
	$4\frac{1}{2}$)4	$6\frac{1}{2}$
Price per yard super	1	0

on

to

"pricking up" coat on laths requires one tenth more coarse stuff than "rendering."

	s	*d*
Lathing only	1	0
Rendering one coat	0	$10\frac{1}{2}$
Price per yard super	1	$10\frac{1}{2}$

By an actual test the author has found that $6\frac{1}{2}$ cubic feet of coarse stuff will cover 10 yards super one coat on lathing and take $1\frac{1}{4}$ hours plasterer and labourer.

Lath, Plaster and Set. The setting is a thin layer of fine stuff plasterer's putty or gauged stuff and one of these finishes should be definitely stated. We will here take fine stuff as the most common. The following materials and labour will be required for 100 yards:—

	£	*s*	*d*
22 bundles laths (lath-and-half) at 2*s* 3*d*	2	9	6
14 lbs wrought nails at 3*d* per lb	0	3	6
2 yards cube unslaked lime at 12*s*	1	4	0
2 ,, ,, land washed sand at 13*s* 6*d*	1	7	0
Carried forward	5	4	0

	£	s.	d.
Brought forward	[illegible]	4	6
[illegible] lbs. hair, at 9s. 6d. per cwt.	0	2	[illegible]
Water, 220 gals., at 1½d. per 25 gals.	0	1	[illegible]
Labour, 42 hours at 1s. 6d. (plasterer, 11d., labourer, 7d.)	3	2	0
Use of scaffolding, erection and removal	0	[illegible]	[illegible]
	[illegible]	12	6
Add 20 per cent. profit, &c.	1	11	6
	10[illegible]	[illegible]	[illegible]
Price per yard super	0	2	1

Lath Plaster Float, and Set.—As in last item the [illegible] should be definitely described, and fine stuff will again be considered. The method of analysis is similar, and 100 yards area is taken:—

	£	s.	d.
22 bundles laths (lath-and-half) at 2s. 3d.	2	9	6
14 lbs. [illegible] nails at [illegible] per lb.	0	5	6
2½ yards cube unslaked lime at 13s.	1	13	0
[illegible] " hand washed sand, at 13s. 6d.	1	13	9
32 lbs. hair at 9s. 6d. per cwt.	0	2	[illegible]
Water 270 gals., at 1½d. per 25 gals.	0	1	4
Labour 57 hours at 1s. 6d. (plasterer 11d., labourer 7d.)	4	5	6
Use of scaffolding, erection and removal	0	2	0
	10	5	4
Add 20 per cent. profit, &c.	2	1	[illegible]
	[illegible]12	10	0
Price per yard super	0	2	6

RENDERING WITH PORTLAND CEMENT

The shrinkage for cement and sand is one-sixth (17 per cent.), but the actual quantities required to cover certain areas will be found in "Memoranda." As sand is sold by the yard cube and not by the bushel, the former measure will be found more convenient for it. There are 21 bushels of sand in a yard cube. The usual thickness for Portland cement and sand rendering is ¾ in., which should be performed in one operation, but ½ in. thick is sufficient for neat cement.

Render in Pure Portland Cement, ½ in. thick.—A bushel of cement will cover 2[illegible] or say 2½ yards super, ½ in. thick, and a plasterer and labourer will take 1½ hours to work them.

labourer 7d)

Add 20 per cent. profit, &c

Price per yard super

Render and Float, ¾ *in thick, with* 1 *Cement to* 1 *Sand* A bushel of cement and a bushel (or $\frac{1}{27}$ yard cube) of sand will cover 3¼ yards super ¾ in thick The time ... hours plasterer and labourer, as when sand is ... cement in rendering there is rather more labour ... material not being so 'fat' and working ... necessitates passing the trowel more frequently through ... mix properly

1 bushel Portland cement

Add 20 per cent profit &c

Price per yard super

Ditto with 1 *Cement to* 2 *Sand* A bushel of ... bushels ($\frac{1}{27}$ yard cube) of sand will cover 4¾ yards ... ¾ in thick The time required will be a little ...

1 bushel Portland cement

Add 20 per cent profit &c

Price per yard super

	£	s	d
Brought forward	1	5	1
Add 20 per cent profit &c	0	5	0
	10)1	10	1
Price per yard super	0	3	0

Limewhiting and Colouring

Limewhite, 1 Coat —Limewhite or whitewash consists of any common fat lime such as chalk lime, mixed with water, ... purposes ... o colour it ... 1 to $1\frac{1}{2}$ ft ... wder, and $\frac{3}{4}$ lb tallow will cover 100 yards super, one coat A plasterer and labourer will take 6 hours to go once over this surface

	s	d
	0	$7\frac{1}{2}$
	0	$0\frac{3}{4}$
	0	$3\frac{3}{4}$
	9	0
	2	0
	12	0
Add 20 per cent profit &c,	2	5
	100)14	5
Price per yard super	0	$1\frac{3}{4}$

In the War Department soldiers are often employed to ... man is supposed to do 80 ... lime = $\frac{1}{2}$ bushel lime per ... ishel lime, and 1 oz green copperas ditto for colouring buff For plant, 6 ft trestles 12 ft scaffold boards, tub for mixing whitewash, 10 ozs brushes, and 3 gals galv iron buckets

Ditto, 2 Coats —From $1\frac{3}{4}$ to 2 ft cube (say $1\frac{3}{4}$ bushel) of lime, and $1\frac{1}{4}$ lb tallow, will cover 100 yards super, two coats Nearly double labour will be required

	s	d
	1	1
	0	1
	0	6
... (amer)	15	0
	2	0
Carried forward	18	8

	s	d
Brought forward	18	8¼
Add 20 per cent profit &c	3	8¾
	100)22	5
Price per yard super	0	2¼

For large surfaces whitewashing can be done with a machine, comprising a galv iron pail or tank holding 6 to 18 gals, with or without wheels, hand pump, ½ in rubber base, spraying nozzles, &c Cost, £3 to £15, depending on capacity The apparatus, worked by a man and boy, will do as much whitewashing in one day as ten men hand brushing The material is supplied in the form of a spray, at a speed of 10 to 20 sq yds per minute, and is driven into corners and difficult places where a brush would not reach

Whitewashing machine

Whitening, with Whiting and Size, 1 *Coat* —Whiting is chiefly used with water alls It is not durable ¼ lb blue black, and 1½ gals size, will cover 100 yards super, one coat Glue,

	s	d
12 lbs whiting at ¼d per lb	0	3
¼ lb blue black at 6d per lb	0	1½
[illegible]	0	6
	0	0¼
	10	6
	2	0
	13	5
Add 20 per cent profit &c	2	8
	100)16	1
Price per yard super	0	2

Ditto 2 *Coats* —21 lbs whiting, ⅜ lb blue black, and 2¾ gals. size will cover 100 yards super, 2 coats Glue, 2¼ lbs, may be substituted for the size as before Allow 12 hours for labour.

	s	d
21 lbs whiting at ¼d per lb	0	5¼
	0	2¼
	0	9¾
	0	1
	18	0
	2	0
	21	6
Add 20 per cent profit &c	4	3¼
	100)25	9½
Price per yard super	0	3

Colouring in Distemper, Stone or Buff, 1 Coat—10 lbs whiting, 3 lbs ochre, ½ lb umber, and 2 gals size (substitute 2 lbs glue) will cover 100 yards super, 1 coat Labour, 8 hours

	s	d
10 lbs whiting at ¼d per lb	0	2½
3 lbs ochre at 1¼d per lb	0	3¾
½ lb umber at 3d per lb	0	1½
2 lbs glue at 3½d per lb	0	7
Water about 10 gals at 1¾d per 25 gals	0	0¾
Labour 8 hours at 1s 6d (plasterer and labourer)	12	0
Use of scaffolding erection and removal	2	0
	15	3½
Add 20 per cent profit &c	3	0
	100)18	4
Price per yard super	0	2¼

Ditto ditto 2 Coats—For two coats larger quantities—21 lbs whiting, 5 lbs ochre ¾ lb umber, and 3 gals size (substitute 3 lbs glue), with 17 gals water, will cover 100 yards super Labour 13 hours

	s	d
21 lbs whiting at ¼d per lb	0	5¼
5 lbs ochre at 1¼d per lb	0	6¼
¾ lb umber at 3d per lb	0	2¼
3 lbs glue at 3½d per lb	0	10½
Water about 17 gals at 1¾d per 25 gals	0	1
Labour 13 hours at 1s 6d (plasterer and labourer)	19	6
Use of scaffolding erection and removal	2	0
	23	7¼
Add 20 per cent profit &c	4	8½
	100)28	4
Price per yard super	0	3½

Colouring in Distemper French Grey, 1 Coat —This is a superior colour 12 lbs whiting, 1½ lbs Prussian blue, and 2 gals size (substitute 2 lbs glue) will cover 100 yards super, 1 coat Labour, 8 hours

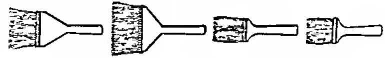
	s	d
[illegible]	0	3
	4	6
	0	7
	0	0¾
	12	0
	2	0
	19	4¾
Add 20 per cent profit &c	3	10½
	100)23	3¼
Price per yard super	0	2¾

Ditto ditto, 2 Coats —For two coats larger quantities—21 lbs whiting, 2½ lbs Prussian blue, and 3 gals size (substitute 3 lbs glue), with 17 gals water will cover 100 yards super Labour 13 hours

	s	d
21 lbs whiting at ¼d per lb	0	5¼
2½ lbs Prussian blue at 3s per lb	7	6
3 lbs glue at 3½d per lb	0	10½
Water about 17 gals at 1½d per 25 gals	0	1
Labour 13 hours at 1s 6d (plasterer and labourer)	19	6
Use of scaffolding erection and removal	2	0
	30	4¾
Add 20 per cent profit &c	6	1
	100)36	5¾
Price per yard super	0	4¼

Comparison of Finished Surfaces —Summary and comparison of the cost of the foregoing and other finished surfaces common colours

	Preliminary Surface (1 coat) d	Finished Surface (coats). d
Limewhiting	1¼	2½
Whitening	–	3
Colouring	2	2¾
Ordinary Distemper	–½	3½
Sanitary Washable Distemper	3	4
Duresco	3½	4½



Copper wire tied — Leather bound — Copper wire tied — Copper bound
Stock Brushes — Distemper Brushes

MISCELLANEOUS

Raking out Mortar Joints of old Brickwork, Washing, &c—Th[illegible] bing and satu[illegible] will mostly be [illegible] removing this must be taken into account A plasterer and labourer will then be able to do 3 yards per hour

	s	d
1 hour (plasterer and labourer)	1	6
Use of scaffolding erection and removal	0	0¾
	1	6¾
Add 20 per cent profit &c	0	3¾
	3)1	10½
Price per yard super	0	7½

For cement joints the labour will be half as much again, or 11*d* per yard super total

Rough Casting 2 Coats—For lime rough casting or pebble dashing 20 bushels lime 2 yards cube sand, 16 lbs hair and ¾ yard cube gravel for the dash coat will cover 100 yards super 2 coats Labour will be 15 hours plasterer and labourer

	£	s	d
20 bushels white chalk lime at 7½*d*	0	12	6
2 yards cube hand washed sand at 13*s* 6*d*	1	7	0
16 lbs hair at 9*s* 6*d* per cwt	0	1	4¼
¾ yard cube gravel at 6*s* 6*d*	0	4	10½
Water 100 gals at say 1½*d* per 25 gals	0	0	6
Labour 15 hours at 1*s* 6*d* (plasterer and labourer)	1	2	6
Use of scaffolding erection and removal	0	2	0
	3	10	8¾
Add 20 per cent profit &c	0	14	1¾
	100)4	4	10½
Price per yard super	0	0	10

To colour the above drab, add 5 lbs. copperas, and 1 lb. fresh cow-manure, strained and mixed with the liquid dash. For *terra cotta*, add 5 lbs. copperas, 14 lbs. red metallic oxide, and 4 lbs. lampblack. The addition of 10 per cent. of alum solution will give brilliancy and permanency to the colours.

CHAPTER XXI.—PAINTER.

MEMORANDA

BUILDINGS should be painted externally once every 3 years internally every 6 years Time, spring or autumn

WEIGHTS.

1 ft cube of white lead ground in oil	weighs	250 lbs
" " " dry	"	400 lbs
" coal tar	"	63 lbs
One gallon of linseed oil	"	9 lb
" turpentine	"	8½ lbs
" coal tar	"	10 lbs
creosote	"	10½ lbs
pitch	"	11 lb
special paint	"	25 lbs
One barrel of turpentine	equals	50 gals
" wood tar	"	24 gals

COVERING POWERS

1 lb ready mixed paint covers on	wood	4 yds	super	1st coat
" " " "	"	6 yds	"	2nd "
" " " "	"	7 yds	"	3rd "
" " " "	"	7 yds	"	4th "
1 gal " "	stone	25 to 30	yds super	
"	compo	40 " 60	"	
	wood	60 " 80	"	
	iron	80 " 100	"	
any special paint "	wood	100 " 110	"	
Szerelmey stone liquid covers stone 3 coats		20	"	

1 lb of glue and 1 gal of water make 1 gal of size

PROPORTIONS OF MATERIALS

The quantities of materials vary according to the surface to be painted on, the nature of the paint, and according to the ideas of the painter. Each succeeding coat covers a larger surface with the same quantity of paint than the previous one The area covered also depends on the state of the weather when the paint is being laid on, whether warm or cold wet or dry, &c

PROPORTIONS OF PAINTING MATERIALS

Description	Glue or Size	Putty	Pumice Stone	Glass Paper	Red Lead	Dry White Lead	Raw Linseed Oil	Boiled Linseed Oil	Turps	Driers	Labour — Painter
To cover 100 yards super	lb	lbs	lb	quires	lbs	lbs	pints	pints	pints	lb	hours
Knotting	¼	—	—	—	¼		—		—	—	6
Stopping		4½	½	1		2½				—	5
Inside Work											
(Four coats not flatted.)											
1st coat or priming			—		½	16	6	—		¼	10
2nd						15	3½		1½	¼	14
3rd		—				13	2½	—	1½	¼	14
4th	—				—	13	2½		1½	¼	14
(Four coats and flatting.)											
1st coat or priming					1½	16	6		½	⅛	10
2nd			—		—	12	4	—	1½	1/10	14
3rd		—				12	4		—	1/10	14
4th			—			12	4	—	—	1/10	14
Flatting				—		9	—	—	3½	1/10	14
Outside Work											
(Four coats not flatted.)											
1st coat or priming					2	18½	2	2	—	⅛	10
2nd						15	2	2	½	1/10	14
3rd					—	15	2	2	½	1/10	14
4th		—				15	3	2½	—	1/10	14

2 pints = 1 quart and 4 quarts = 1 gallon 8 pints = 1 gallon.

PROPORTIONS OF MATERIALS—*continued*

The foregoing amounts (from "Notes on Building Construction," vol iii) per cwt make about a gallon of paint and cover 100 yards super on new wrought deal

These form white paint, to the last two coats of which various pigments may be added according to the colour required, in the proportion of 10 to 20 ozs per 100 yards of surface to be painted, the quantity of white lead being reduced in proportion

RELATIVE COST OF PAINTS

(J Cruickshank Smith, B Sc F C S)

Relative Items	Red Lead	White Lead	Zinc White	Red Oxide
Covering capacity per cwt in square yards	594 yds	866 yds	1,411 yds	1,093 yds
Price per cwt in shillings	32s	32s	36s	28s
Cost per 100 square feet in shillings	60s	44s	28s	28s
Times painted in 20 years	3	5	5	7
Cost per 100 square feet for 20 years in shillings	1 80s	2 20s	1 40s	1 96s
Relative economic value on a 20 years basis, the highest value being represented by 100	77	64	100	71

DURESCO

MEASUREMENT TABLE

The figures show body colour only, and to this must be added ¼ cwt petrifying liquid to each cwt of body

Duresco	14 lbs	28 lbs	56 lbs	112 lbs
1 coat	112 yards	225 yards	450 yards	900 yards
2 coats	56 "	112 "	225 "	450 "
3 coats	37 "	75 "	150 "	300 "

This table has now been in daily use for over seventeen years the orders of customers having been calculated by it during all that time

Black Paint

12½ lbs lamp black ¾ lb driers (litharge) 2¼ pints raw linseed oil 2¼ pints boiled linseed oil	will cover 100 yards super

Oxide of Iron Paint

Oxide of iron paints weight for weight usually cover a surface of 1½ to 2 that of white lead paint and require for thinning about 6½ gals linseed oil (½ boiled and ½ raw) and 2 gals turpentine per cwt of the oxide ground in oil

1 lb ready mixed Calles and Wolston s Torbay paint covers on iron	10 yds super	1st coat
	15	2nd
	20	3rd
1 lb ready mixed red lead paint covers on iron	5	1st
	7	2nd
	10	3rd

Anti Corrosion Paint

1 cwt dry Carson s anti corrosion paint requires 8 to 10 gals oil mixture and covers 400 to 500 yards super on woodwork 1 coat

1 cwt dry Carson s anti corrosion paint requires 8 to 10 gals oil mixture and covers 600 to 700 yards super on ironwork 1 coat

Varnishing

1 gallon varnish covers	60 to 80 yards super	1st coat on wood
1 " "	100 120	2nd
1 gal liquid stain will cover	100 yards super	per

Gilding

Gold leaf is classed as singles doubles or trebles A book of gold leaf contains 25 leaves 3¼ in × 3¼ in or 1 ft 10 in super and will cover about a foot super of plain work It is calculated by the 1 000 leaves

Silver leaf books contain 48 leaves 4½ in × 4½ in or 6 ft 9 in sup

Tarring

1 gal tar with 1 lb pitch will cover	20 yards super	1st coat on wood
	25	2nd

Constants of Labour

		Hours	
Knotting	per yd sup	·05	painter
Stopping		·05	
1st or priming coat on wood		·16	
2nd and following coats each		·14	
1st coat on iron		·25	
2nd and following coats each		·22	
Add if painting done from a ladder		·10	

Constants of Labour—*continued*

		Hours	
Iron bars, fillets &c 1 coat	per yd run	06	painter
Sash squares each side 1st coat	per doz	50	
2nd coat		40	
Tarring 1st coat on wood	per yd sup	25	labourer
2nd and following coats		20	
1st coat on iron		28	
2nd		21	

PRICES

Including all preparatory work such as scraping stopping knotting, cleaning, washing, rubbing down, use of plant &c

Common Colours

(White stone brown chocolate lead black &c)

Description	One Coat	Two Coats	Three Coats	Four Coats	Flatting
Superficial Work	s d	s d	s d	s d	s d
Plain painting on wood per yd sup	0 6	0 9	1 0	1 3	0 2½
Carved work ditto	1 0	1 6	2 0	2 6	0 5
Plain cornices entablatures fascias pilasters &c per yd sup	0 7	0 10	1 1	1 4	0 3½
[illegible]	0 11	1 5	1 11	2 5	0 6
[illegible]	0 8	1 0	1 4	1 8	0 4
[illegible]	0 7	0 10	1 2	1 5	—
Skylights to out and out of frame one side per yd sup (For external work done off scaffolding add 5 to 20 per cent)	0 8	1 0	1 4	1 7	0 [illegible]
Lineal Work					
Eaves gutters inside and out with brackets per yd run	0 6	0 8	0 10	1 0	—
Add for cleaning out ditto and stanching joints with red or white lead per yd run	0 1½	—	—	—	—
Rain water soil and vent pipes	0 4	0 5	0 7	0 [illegible]	—
B[illegible]	[illegible] 1½	0 2	0 2½	0 3	—
Ar[illegible] bands frames fillets &c under 4 in girth hand rails reveals &c and angle iron skirting mouldings &c under 9 in girth per yd run	0 2	0 3	0 4	0 5	0 1½
Skirtings and mouldings &c 9 in to 14 in girth per yd run	0 3	0 4½	0 6	0 7½	0 2

COMMON COLOURS—*continued*

Description		One Coat		Two Coats		Three Coats		Four Coats		Flatting	
NUMERAL WORK		*s*	*d*	*s*	*d*	*s*	*d*	*s*	*d*	*s*	*d*
Ashbins, outside	each	2	0	2	8	3	6	4	6	—	
Balusters, or small newels	"	0	1½	0	2	0	2½	0	3	0	1
Bails, including chains	"	0	5	0	7	0	10	1	2	—	
Bell boards, 3 ft × 9 in	"	0	3	0	4	0	5	0	6	0	2
Brackets or cantilevers, small	"	0	2	0	3	0	4	0	5	0	1
" " large	"	0	6	0	9	1	0	1	3	0	3
Casement lights, one side		0	6	0	8	0	10	1	0	0	2
Casement frames, 2 light	"	0	7	0	10	1	1	1	4	0	3
Chimney pieces, plain	,	1	0	1	4	1	8	2	0	0	6
" ornamental	"	1	3	1	8	2	1	2	6	0	8
Cisterns, feed, or W W P	,	0	0	0	9	1	0	1	3	—	
Casement fasteners	per doz	0	8	0	10	1	0	1	2	—	
			2	0	3	0	4	0	5	—	
			7	0	10	1	1	1	4	0	8
			2	0	3	0	4	0	5	0	1
			6	2	3	3	0	3	9	—	
Hopper heads for R.W pipes	"	0	4	0	5	0	6	0	7	—	
Heads and shoes, iron, for roof trusses	"	0	3	0	4	0	5	0	6	—	
Hinges, swing bars, springs, &c	"	0	4	0	5	0	6	0	7	—	
Hooks, pins, staples, knobs, buttons, bolts, nuts, small hinges latches, handles, rings &c	per doz	1	0	1	3	1	6	1	9	—	
Heads or nuts of bolts		0	3	0	4	0	5	0	6	—	
Lamps, and lamp irons	each	0	4	0	6	0	8	0	10	—	
Lamp posts and columns drying posts heel posts, &c		0	9	1	1	1	5	1	9	—	
Locks including staples		0	2	0	3	0	4	0	5	0	1
Pumps, including handles	,	0	9	1	2	1	7	2	0	—	
Rafter feet where exposed		0	2	0	3	0	4	0	5	—	
Sash or door frames, one side, under *10 ft super*		0	6	0	9	1	0	1	3	0	3
Ditto, ditto, 10 ft to 25 ft super	,	1	0	1	6	2	0	2	6	0	6
Ditto, ditto, 25 ft to 40 ft super		2	0	2	6	3	0	3	6	0	9
	,		6	0	9	1	0	1	3	0	3
			3	1	6	1	9	2	0	0	6
			2	0	3	0	4	0	5	—	
			3	0	4	0	5	0	6	0	1

Behind Bars—For painting behind fixed guard bars add 10 % to respective items

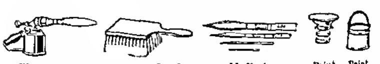
Stone or Cement—For painting stone or cement add 10 to 20 % to cost for woodwork on account of the extra absorption and trouble

Cheap Paints—Deduct 5 to 10 % from common colours for anti corrosion, granitic, oxide of iron, and zinc paints.

Oxide of Iron Paints

			s	d
Plain painting on iron	1 coat	per yd sup	0	4
	2 coats		0	7½
	3 coats		0	11

Miscellaneous



Blow Lamp Stippling Brush Sable Writers Paint Strainer Paint Kettle

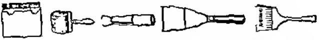
		s	d
Burning off or removing paint by chemicals	per yd sup	1	0
Oiling and preparing brick or stucco &c for the first coat		0	3
Pumicing and preparing old work		0	3
Cleaning paintwork when ordered separately from painting by washing with soap (including soap)		0	2
Stippling surfaces last coat add		0	2
Sanding including the sanding coat		0	6
Writing plain letters or figures one coat	per inch high	0	0¾
two coats		0	1
shaded		0	1½

Superior Colours

(Bright green red pink blue grey indigo yellow &c)

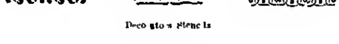
Description		One Coat	Two Coats	Flatting
		s d	s d	s d
Superior colours as above for the last two coats	per yd sup	0 9	1 0	0 5
Plain cornices and mouldings columns pilasters &c		0 11	1 2	0 8
Enriched cornices or other carved work		1 3	1 9	0 10
Moulded skirting		0 10	1 1	0 7
Chair rail rail and pin angle staff bands fillets &c	per ft run	0 1½	0 2	0 1
Shelf edge		0 0½	0 1	0 0½
Balusters or small newels	each	0 3	0 4	0 1½
Chimney pieces		1 2	1 6	0 10
Consoles	"	0 11	1 3	0 8
Pilaster caps		0 9	1 0	0 7
Sash frames or cases 10 to 25 ft sup		1 6	2 0	0 9
squares 1 to 2½ ft sup	per doz	1 6	2 0	0 9

VARNISHING, GRAINING, &c



Graining Comb Graining Roller Stencil Brush Painter's Scraper Badger Softener

Description	Copal Varnish One Coat	Copal Varnish Two Coats	Graining Oak	Graining Maple	Graining Clean and Touch up	Stain One Coat	Size One Coat
	s d	s d	s d	s d	s d	s d	s d
Superficial work per yd sup	0 7½	1 0	1 6	2 3	0 5	0 3	0 1
Skirting, surbase, chair rail per ft sup	0 2	0 3	0 4	0 6	0 2	0 1	0 0½
Handrails per ft run	0 2	0 3	0 3	0 5	0 1	0 1	0 0½
Shelf edge	0 0½	0 0¾	0 2	0 4	0 0½	0 0½	0 0¼
Skirting narrow	0 1	0 2	0 2½	0 5	0 0½	0 0½	0 0½
Balusters or newels each	0 2	0 3½	0 4	0 6	0 1½	0 1	0 0½
Fanlights and frames one side	1 0	1 8	2 3	3 0	0 5	0 3½	0 3½
Sash frames one side	0 9	1 2	2 3	3 1	0 5	0 5	0 2½
Sash transoms one side	0 4	0 7	1 0	1 9	0 2½	0 2½	0 1
Door frames including architraves	2 2	3 0	2 9	4 0	0 7	1 1	0 3
Sash squares 1 to 2½ ft super per doz	0 10	1 6	2 3	3 6	0 4½	0 1½	0 2



Decorators' Stencils

FRENCH POLISHING, &c.

		s d
F	per ft sup	0 7
	per ft run	0 6
		0 3
woodwork	per ft sup	0 4
Wax polishing floors with beeswax and turpentine		0 6

GILDING

		s d
G	per ft sup	5 0
		6 6
	per inch high	0 2
4 8 in		0 2½
8 12 in		0 3

Tarring

Description		One Coat s	d	Two Coats s	d
[illegible]	per yd sup	0	2¼	0	5
		0	2	0	4
Ditto water or gas pipes	per ft run	0	0½	0	1½
Tarring on new felt roofing with purified coal tar and spent lime or pounded chalk and sanding with clean sand	per square	2	0	3	0
Ditto after one year's wear ditto		2	6	3	[illegible]
two years ditto		3	[illegible]	[illegible]	[illegible]

Add 25 % if tarring is done from boats or in tide work.

Materials

(WITHOUT PROFIT)

		s	d
Alum powdered or lump	per lb	0	3
Atkinson's composition for removing and cleaning paint		1	0
Beeswax genuine yellow		2	0
Bricks Bath	each	0	1½
Copperas green	per cwt	[illegible]	0
white		16	0
Driers patent for white lead paints	per lb	0	3
Torbay paste (34 per cwt)		0	3½
for zinc paints		0	5
liquid Terebene	per gal	10	0
Torbay liquid		7	[illegible]
Dragon's blood powdered	per lb	2	[illegible]
Flannel best quality for cleaning 2ft wide	per yard	0	[illegible]
French polish best	per gal	12	[illegible]
Glue good bright for size only	per lb	0	4
Glass paper sand or emery	per quire	0	10
Gold leaf double	per book	2	0
Gold size gilder's for sign writing	per gal	9	0
Gold size Japan		10	6
Knotting patent		11	0
Lead red dry (£24 per ton)	per lb	0	3
ground in oil		0	3½
white dry (£28 per ton)		0	3
ground in oil		0	3½
sugar of		0	4
Linseed oil raw	per gal	4	0
boiled		4	3
Litharge (oxide of lead) drier	per lb	0	4
Mordant to make paint adhere to zinc surfaces (composed of soft water 64 parts chloride of copper 1 part nitrate of copper 1 part sal ammoniac 1 part and hydrochloric acid 1 part)	per gal	4	0

MATERIALS—*continued*

		s	d
Mordant, Torbay Paint Co s (1 gal mixed with 3 gals water)	per gal	10	0
Naphtha spirit	,,	3	6
Olive oil Spanish	,	5	0
Paint, dry, anti corrosion	per lb	0	5
,, ,, blue black	,,	0	3
,, , ivory black		0	9
, ,, Venetian red		0	2
, ,, lampblack		0	3
, , green copperas		0	1
,, ,, ochre yellow or red		0	1½
,, ,, Prussian blue		3	0
,, ,, ultramarine blue		1	0
,, , Vandyke brown		0	7½
, , Spanish brown		0	3
,, raw umber, Turkey		0	3
,, raw sienna		0	7
,, burnt sienna		0	9
, Brunswick green		0	6
,, , oxide of zinc		0	4
silicate oxide of iron		0	3
Paint ground in oil emerald green		1	0
sulphide of zinc		0	4
, vermilion		4	0
Paint Calley and Wolston s Torbay oxide of iron (browns and reds) ground in oil paste (36s per cwt)		0	4
Paint Calley and Wolston s Torbay oxide of iron			
	per gal	6	0
		4	6
	per lb	0	1
. vt)		0	1½
Potash American		0	6
Pumice stone lump or powdered		0	4
Putty linseed oil		0	1½
,, white or red lead		0	3½
Size, best quality concentrated parchment		0	6
Soda common crystal (6s per cwt)		0	0¾
Soft soap		0	3
Sulphate of copper		0	5
Stains oil oak or mahogany	per gal	9	0
Szerelmey stone liquid in 5 gal drums		7	6
, iron paints common colours ready for use		8	0
		4	0
		0	4
		1	1
		3	9
Varnish Brunswick black		8	0
, copal best pale		18	0
,, Japan black		16	0
, naphtha		6	0
, oak pale		10	0
,, staining		12	0
, hard spirit		6	6
,, Berlin black		14	0

MATERIALS—*continued*

		s	d
Whiting best washed in lumps (2s 4d per cwt)	per lb	0	0½
Wine spirits of	per pint	3	6
methylated		1	0
Wood preservative Carbolineum avenarius in drums	per gal	3	9
in casks		2	8
Solignum in drums of 1 5 9 10 gals		2	0
in casks of 40 gals		1	9
Zinc paint genuine white (38s per cwt)	per lb	0	1

WAGES

Wages painter s	per hour	0	9
painters labourer		0	6½
grainer s or writer s		1	0
French polisher s		0	9
gilder s		1	0

ANALYSIS

MATERIALS

The materials required for painting are *bases* (white lead red lead zinc white, oxide of iron) *vehicles* (water oils spirits of turpentine) *solvents* (spirits of turpentine) *driers* (litharge acetate of lead sulphate of zinc binoxide of manganese red lead &c) *colouring pigments* (ochres lamp black umber sienna &c)

Bases —White lead is a carbonate of the metal It gives the body and combines with the oil to form a soapy substance It is sold either dry in powder or else ground in linseed oil and should be genuine White lead is frequently adulterated with sulphate of baryta sulphate of lead zinc white whiting chalk &c Such substitutes are deficient in want of body and in covering power as compared with white lead Old white lead of good quality goes further and lasts better than if it is used when fresh

Red lead is an oxide of lead and is usually in the form of a bright red powder It is sometimes adulterated with brick dust

Zinc white is an oxide of zinc and is the basis of zinc paint It is permanent in all circumstances and situations and very durable, does not darken after application but always keeps its brightness is entirely innocuous and owing

1

Memoranda The reader is warned however, that much

the name zinc white are sold two entirely different pigments—zinc oxide, and a substance known as lithopone The well known Charlton white is a typical example of the latter It consists of sulphide of zinc and artificial barytes or sulphate of barium which are entirely different to natural

e is not

use

tite ore

found at Torbay in Devonshire Such materials undoubtedly have more affinity for iron than lead paints and are cheaper as weight for weight they go further

Vehicles—Linseed oil is a fixed or fatty oil obtained by

prepared by heating raw oil with certain driers or by passing a current of air through raw oil It is thicker and darker in colour and is used for outside work because it dries better

Solvents—Spirits or oil of turpentine commonly called ' Turps is an essential or volatile oil produced by distilling turpentine tapped from pines or larches The best comes from America Turpentine is merely used as thinnings to make the paint work more freely and so save the oil It is useful in flatting coats as it takes away the glare of the linseed oil but will not stand exposure to the weather Benzine is sometimes employed as an adulterant

Driers—As the drying of linseed oil is due to the readiness with which it absorbs oxygen the process is quickened by adding substances called driers which in giving up the oxygen which they contain assist the oxidation of the oil As also many pigments retard the drying of the oil the addition of driers is necessary to prevent the paint from remaining sticky or tacky Litharge or oxide of lead, is the most common drier Massicot is a superior kind of litharge often employed Acetate of lead or sugar of lead, ground in oil sulphate of zinc (improperly called white copperas and white vitriol) especially for light tints binoxide of manganese for dark colours and quick drying red lead not so quick as litharge and other substances are all used

Patent driers contain certain of the foregoing, ground and mixed in oil, and therefore in a convenient form for use in turpentine Resin

e it dry

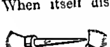
le to give even a bare

i so many substances,

t they may be properly

rth pigments, such as sienna, umber, oxide of iron, &c, chemical colours, such as chrome yellow, Prussian blue, etc, and (3) the lakes consisting of an aniline dye precipitated on to a white base As pigments are only used for colouring the bases are reduced in proportion

Tar —Coal tar is a by product in the manufacture of gas When itself distilled it produces in various stages coal naphtha, creosote, and pitch (not to be confounded with mineral pitch or bitumen) Coal tar is cheaper than wood tar Wood tar is produced from the resinous products of firs and pines It is imported in barrels containing 25 to 30 gallons, chiefly from Stockholm and Archangel Being thinner than coal tar, it enters the pores of the wood more freely, and so preserves it better The residue after distillation is also pitch



Tar Brushes

Pitch is added to both coal and wood tar, in the proportion of 1 lb pitch to 1 gal tar, in order to fix it, and prevent its running in hot weather A little lime is added for the same purpose Another mixture is 1 lb pitch and 1 lb resin to 6 gals of coal tar Tar should be applied hot

Knotting —Knotting prevents the exudation of turpentine from knots, or knots from absorbing the paint, thus leaving marks on the painted surface Hot lime can be used to kill knots but, as it takes time, patent knotting chiefly shellac dissolved in methylated spirit, is more frequently employed as it dries in five minutes Red lead ground in water, and mixed with strong glue size, and used hot, is often considered preferable to patent knotting, and dries in ten minutes

of whiting (powdered

a stiff paste, and well

required per 20 to 25

yds sup, or

Varnish —Varnish is a solution of resin in either oil, turpentine or alcohol The turpentine and alcohol evaporate leaving a solid transparent film of resin over the

surface varnished The oil also remains as forming an important part of the varnish, and of course hardens by absorbing oxygen from the atmosphere

Varnish Brush

Copal varnish is the best, and is prepared from gum copal dissolved under heat with the best linseed oil No other kind should be used for outside work Common varnish is made by dissolving 2 lbs resin, under a gentle heat, in 1 gal linseed oil, and then adding gradually 1 quart turpentine Cheap oak varnish is used for common work, and is made by dissolving 3½ lbs resin in 1 gal turpentine, but there are over 40 varieties for different uses

French Polish —French polish is made by dissolving 1½ lbs shellac in 1 gal spirits of wine, without heat, but there are other recipes

Repairs Prior

For repairs prior to painting or varnishing allow 10 per cent of the cost of the painting or varnishing

Common Colours

Ladders —For use of ladders trestles planks and brushes a covering sum is put down of ½d per yard super per coat This equals say 4s per coat per 100 yards super But as ladders are only necessary for high work less may be sufficient for over all

Knotting —This is the first operation If red lead knotting is used, then ¼ lb of red lead and ¼ lb glue mixed with water and applied hot equal ¾ lb paste, will cover 100 yards super When knotting varnish is employed allow 1 pint per 100 yds plain painting Labour 5 hours painter

	s	d
¼ lb red lead dry at 3d	0	1
¼ lb glue at 4d per lb	0	1½
5 hours painter at 9d	3	9
Use of ladders planks &c	4	0
	7	11½
Add 20 per cent profit &c	1	7
	100)9	6½
Price per yard super	0	1

Stopping —Priming or first coat is really the next operation, stopping being done on the top of this otherwise the unpainted wood will absorb the oil out of the putty and prevent it from adhering but for the sake of convenience

COMMON COLOURS—*continued*

the latter is analysed first, 4½ lbs putty, ½ lb pumice stone and 1 quire glasspaper will be required for 100 yards super Labour as last item

	s	d
4½ lbs oil putty at 1½*d*	0	6¾
½ lb pumice stone at 4*d*	0	2
1 quire glasspaper at 10*d*	0	10
2½ lbs white lead dry at 3*d*	0	[illegible]
5 hours painter at 9*d*	3	9
Use of ladders planks &c	4	0
	9	11¼
Add 20 per cent profit &c	1	11¾
	100)11	11
Price per yard super	0	1½

Plain Painting, 1 *Coat*.—This is the priming coat and to obtain its complete value, including preparatory work the ... d ... rs ... in

Memoranda

Paint Br 1

Labour, 16 hours painter

Take wherever the brush goes and for simplicity measure on the flat, adding ⅛th for beads, edges returns &c in plain work But for a first class job proper quantities should be taken

	s	d
½ lb red lead dry at 3*d*	0	1½
16 lbs white lead dry at 3*d*	4	0
6 pints = ¾ gal raw linseed oil at 4*s* per gal	3	0
¼ lb litharge (drier) at 4*d*	0	1
16 hours painter at 9*d*	12	0
Use of ladders planks &c	4	0
	23	2½
Add 20 per cent profit &c	4	7½
	100)27	10
Priming or first coat per yard	0	3¼
Add cost of knotting per yard	0	1
stopping per yard	0	1¼
Total price per yard super	0	6

Ditto 2 *Coats*.—The second coat requires 15 lbs white lead 3½ pints raw linseed oil 1½ pints turpentine and ¼ lb driers

(litharge) per 100 yards inside work Labour 14 hours painter To price of this add value of first coat

	s	d
[illegible]	3	9
	1	9
	0	8½
	0	1
	10	6
Use of ladders planks &c	4	0
	20	9½
Add 20 per cent profit &c	4	2
	100)24	11½
	0	3
Add first coat including knotting and stopping per y s	0	6
Total price per yard super	0	9

Ditto 3 *Coats*—The third coat requires 13 lbs whitelead 2½ pints raw linseed oil 1½ pints turpentine and ¼ lb driers per 100 yards inside work Labour 14 hours painter To price of this add value of first and second coats

	s	d
13 lbs white lead dry at 3d	3	3
	1	3
	0	8½
	0	1
	10	6
Use of ladders planks &c	4	0
	19	9½
Add 20 per cent profit &c	3	10
	100) 3	8
	0	3
Add first and second coats as before per y s	0	9
Total price per yard super	1	0

Ditto 4 *Coats*—From the table in Memoranda it will be seen that the fourth coat requires the same materials and labour as the last coat and therefore the price will be also the same—viz, 3d per yard

	s	d
Cost of first second and third coats per y s	1	0
fourth coat per y s	0	3
Total price per yard super	1	3

COMMON COLOURS—*continued*

Flatting.—This requires 9 lbs white lead 4 pints turpentine and $\frac{1}{10}$ lb driers per 100 yards Labour, 14 hours painter

	s	d
9 lbs white lead dry at 3*d*	0	3
	1	[illegible]
	0	0½
	10	6
Use of ladders planks &c	4	0
	18	5¼
Add 20 per cent profit &c	3	5¾
	100)21	11
Price per yard super	0	0¼

Outside Work.—The cost of outside work can be ascertained in the same way from the table of materials and labour given in Memoranda For external work done off scaffolding add 5 to 20 per cent according to height

[illegible]	[illegible]	nd floor is taken — for scaffolding
[illegible]		10
4		15
5		20

Small Surfaces For the small surfaces in lineal and numeral work such as skirtings pipes &c find what fraction the superficial area of these is to one square yard and then price proportionately adding a suitable percentage for work in small quantities thus —

4 in Cast iron Pipes 2 Coats.—The circumference of this would be 1 ft × 1 yard run = 3 ft super = ⅓ or ⅓ yard super

	s	d
⅓ yard super 2 coats at 9*d* with profit	0	3
Add for work in small quantities say	0	2
Price per yard run	0	[illegible]

Proceed similarly for such items as sash and door frames sash squares &c, in which there will be extra labour The e however can be jumped at without exact calculations

Painting by Machines.—The 'Lightning' Painter or machine, is now being successfully employed by large firms for a variety of work, and is quickly replacing the old method

of hand painting The paint is sprayed evenly and continuously through a flexible tube and nozzle supplied with compressed air either from existing air main or from special compressors There is a great saving in time and labour, the painting speed being 3 sq yds per minute The machine costs from £20 to £30


"Lightning" Painter machine

Expenses for Distance—All work at a distance from the shop of between 1½ to 3 miles to have 10 per cent added for expenses, loss of time &c Above 3 miles and under 6 miles to have 15 per cent added beyond this the necessary railway or lodging expenses as the case may be

Oxide of Iron Paint

For this a reduction of about 10 per cent in cost from common colours is reckoned as a guide in pricing For cash with order, or monthly account the discount is 20 per cent for 20 cwt and upwards 15 per cent for 5 to 20 cwt, and 10 per cent for smaller quantities

Plain Painting 1 *Coat*—1 lb of paint ready mixed, will cover on iron 10 yards super 1 coat Labour, 2½ hours painter, involving scraping and rubbing down but free of knotting and stopping

	s	d
1 lb paint ready mixed at 4d	0	4
[illegible] gal drying oil thinnings at 4 [illegible]	0	2½
2½ hours painter at [illegible]	1	10½
Use of ladders plank &c	0	5
	[illegible]	10
Add 20 per cent profit &c	0	7
	[illegible]	[illegible]
Price per yard super	0	4

Ditto, 2 *Coats*—1 lb of paint will here cover 15 yards super for the second coat Labour 3½ hours painter

	s	d
1 lb paint ready mixed at 4d	0	[illegible]
[illegible] gal drying oil thinnings at 4 [illegible]	[illegible]	[illegible]
3½ hours painter at [illegible]	[illegible]	[illegible]
Use of ladders planks &c	[illegible]	[illegible]
Add 20 per cent profit &c	[illegible]	[illegible]
	[illegible]	[illegible]
Add first coat price per yard	[illegible]	[illegible]
Total price per yard super	[illegible]	[illegible]

Oxide of Iron Paint—*continued*

Ditto 3 Coats.—1 lb of paint will now cover 20 yards super for the third coat. Labour, 4½ hours painter.

	s	d
1 lb paint ready mixed at 4d	0	4
1/20 gal drying oil thinnings at 4s 6d	0	2¾
4½ hours painter at 9d	3	4½
Use of ladders, planks, &c	0	10
	4	9
Add 20 per cent profit, &c	0	11
	20)5	8
	0	3½
Add first and second coats price per y. s.	0	7½
Total price per yard super	0	11

Varnishing

Copal Varnish 1 Coat.—Copal varnish is the best and should alone be used for outside work. It varies very much in price. A gallon will cover 60 to 80 yards, first coat, say 70 y. s.

	s	d
1 gal copal varnish at 18s	18	0
20 hours painter at 9d	15	0
Use of ladders, planks, &c	4	0
	37	0
Add 20 per cent profit, &c	7	5
	70)44	5
Price per yard super	0	7½

Ditto 2 Coats.—A gallon of varnish will go further in the second coat or 100 to 120 yards, say 110 y. s. Labour 18 hours painter.

	s	d
1 gal copal varnish at 18s	18	0
18 hours painter at 9d	13	6
Use of ladders, planks, &c	4	0
	35	6
Add 20 per cent profit, &c	7	1
	110)42	7
	0	4½
Add first coat per y. s.	0	7½
Total price per yard super	1	0

Preparatory sizing will prevent too much absorption and this would cost 1d per y. s. extra.

TARRING

Tarring, 1 Coat—1 gal tar, mixed with 1 lb pitch and applied hot, will cover 20 yards super, first coat on wood Labour, 3 hours of labourer

	s	d
1 gal Stockholm tar	1	1
1 lb Stockholm pitch	0	1¼
Fuel $\frac{1}{10}$ cwt coal at 20s per ton	0	1
3 hours labourer at 6½d	1	7½
Use of ladders, planks &c	0	9½
	3	8¼
Add 20 per cent profit &c.	0	8¾
	20)4	5
Price per yard super	0	2½

Ditto, 2 Coats—The same materials will cover 25 yards for the second coat Labour 3½ hours

	s	d
1 gal Stockholm tar	1	1
1 lb Stockholm pitch	0	1¼
Fuel $\frac{1}{10}$ cwt coal at 20s per ton	0	1
3½ hours labourer at 6½d	1	10¾
Use of ladders planks &c	1	0
	4	2
Add 20 per cent profit &c	0	10
	25)5	0
	0	2½
Add first coat per y[illegible]	0	2½
Total price per yard super	0	5

OXIDE OF IRON PAINT—*continued*

Ditto 3 Coats—1 lb of paint will now cover 20 yards super for the third coat Labour, 4½ hours painter

	s	d
1 lb paint ready mixed at 4*d*	0	4
$\frac{1}{32}$ gal drying oil thinnings at 4s 6*d*	0	1¾
4½ hours painter at 9*d*	3	4½
Use of ladders planks &c	0	10
	4	9
Add 20 per cent profit &c	0	11
	20)5	8
	0	3½
Add first and second coats price per y s	0	7½
Total price per yard super	0	11

VARNISHING

Copal Varnish 1 Coat—Copal varnish is the best and should alone be used for outside work It varies very much in price A gallon will cover 60 to 80 yards, first coat say 70 y s

	s	d
1 gal copal varnish at 18s	18	0
20 hours painter at 9*d*	15	0
Use of ladders planks &c	4	0
	37	0
Add 20 per cent profit &c	7	5
	70)44	5
Price per yard super	0	7½

Ditto 2 Coats—A gallon of varnish will go further in the second coat or 100 to 120 yards, say 110 y s Labour, 18 hours painter

	s	d
1 gal copal varnish at 18s	18	0
18 hours painter at 9*d*	13	6
Use of ladders planks &c	4	0
	35	6
Add 20 per cent profit &c	7	1
	110)42	7
	0	4½
Add first coat per y s	0	7½
Total price per yard super	1	0

Preparatory sizing will prevent too much absorption and this would cost 1*d* per y s extra

TARRING

Tarring, 1 *Coat* —1 gal tar, mixed with 1 lb pitch and applied hot, will cover 20 yards super, first coat on wood Labour, 3 hours of labourer

	s	d
1 gal Stockholm tar	1	1
1 lb Stockholm pitch	0	1¼
Fuel $\frac{1}{10}$ cwt coal at 20*s* per ton	0	1
3 hours labourer at 6½*d*	1	7½
Use of ladders, planks &c	0	9½
	3	8¼
Add 20 per cent profit &c.	0	8¾
	20)4	5
Price per yard super	0	2½

Ditto, 2 *Coats* —The same materials will cover 25 yards for the second coat Labour 3½ hours

	s	d
1 gal Stockholm tar	1	1
1 lb Stockholm pitch	0	1¼
Fuel $\frac{1}{10}$ cwt coal at 20*s* per ton	0	1
3½ hours labourer at 6½*d*	1	10¾
Use of ladders planks &c	1	0
	4	2
Add 20 per cent profit &c	0	10
	25)5	0
	0	2½
Add first coat per y s	0	2½
Total price per yard super	0	5

CHAPTER XXII.—GLAZIER.

MEMORANDA

Crown Glass	A crate contains	12	tables of the	best
"	"	15	"	seconds
"	"	18	"	thirds
"	"	18	"	fourths

The tables measure either 48 in or 54 in diameter The former yields about $8\frac{1}{2}$ ft super. of glass fit for glazing and the latter about $11\frac{1}{2}$ ft super. For every $\frac{1}{16}$ in thick it weighs 13 oz per foot super Crown glass has almost gone out of use

Sheet Glass —Sheet glass may be obtained in four qualities —best 2nds 3rds, and 4ths, weighing 15 to 42 oz per f s

Limits of Size in Sheet Glass

The extreme limits of length and width cannot be combined in the same sheet Average size, 50 in × 36 in

Weight	Thickness	Extreme Length	Extreme Width	Extreme Area
15 oz	$\frac{1}{12}$ in	60 in	40 in	15 ft
21	[illegible]	80 "	50 "	26 "
26	[illegible]	60 "	50 "	25 "
32	[illegible]	75 "	49 "	20 "
36	[illegible]	70 "	44 "	17
42	[illegible]	60	40 "	15

For every $\frac{1}{16}$ in thick it weighs 13 oz per foot super English sheet glass is sold in crates of 200 to 400 ft super

15 oz	has 40	sheets, of	stock sizes	per crate
21 oz	34	"	"	"
26 oz	28		"	"

Foreign sheet glass is sold in cases of 300 ft for 15 oz of 3rd and 4th qualities, and per cases of 200 ft for all other weights and qualities

Rolled Plate —Rough rolled plate (plain and fluted) may be obtained in thicknesses of $\frac{1}{8}$ in, $\frac{3}{16}$ in, $\frac{1}{4}$ in, and $\frac{3}{8}$ in, and up to 120 in long or 42 in wide, and 30 ft in area For every $\frac{1}{8}$ in thick it weighs 16 oz per foot super The plain rolled means fine lines on the surface.

The fluted glass is in two patterns The small pattern has 11 flutes per inch, and the large down to 4 flutes per inch

Rough Cast Plate —Used for roofs, skylights, &c , and may be obtained up to 60 ft in area when the thickness does not exceed $\frac{1}{4}$ in , $\frac{3}{8}$ in , $\frac{1}{2}$ in , $\frac{5}{8}$ in , or $\frac{3}{4}$ in , and 40 ft area when the thickness is $\frac{7}{8}$ in or 1 in

British Polished Plate —Silvering, best glazing, and ordinary glazing qualities can be obtained up to 100 ft in area The glazing qualities are usually $\frac{1}{8}$ in , $\frac{3}{16}$ in , $\frac{1}{4}$ in , and $\frac{3}{8}$ in

Number	No 1	No 2	No 3	No 4
Thickness	$\frac{1}{18}$ in	$\frac{1}{12}$ in	$\frac{1}{10}$ in	$\frac{1}{8}$ in
Weight per ft super	13 oz	14 oz	21 oz	24 oz

Cathedral Glass —Rolled cathedral glass, in light variable tints, weighs 16 to 26 oz to the foot super , and $\frac{1}{8}$ in thick, and runs up to 90 in long or 36 in wide

Constants of Labour

		Hours of a glazier
Crown glass stopped in new sashes	per ft sup	20
old sashes		60
Sheet glass stopped in large squares in new sashes		15
old sashes		40
Hacking out glass includ i g painting putty		30
Cleaning windows both sides		01

PRICES

Lead Lights

		s	d
New lead lights of fret lead glazed with $\frac{1}{8}$ in thick sheet or patent rolled plate glass or with cathedral glass including cementing banding and f.	per ft sup	1	9
		2	0
		0	$2\frac{1}{2}$
D tto ditto in stonework ditto		0	3
Casements pinned in		0	4
	each	0	7
Glass bull s-eyes 5 in diam and 2 in thick bedded in red lead		1	6

Circular and Goth c heads to be meas ired as square and one third added to the price Small pieces under 1 f s to be paid for as 1 f s.

SHEET GLASS
(TRADE DISCOUNT DEDUCTED)

Description		Best 15 oz	Best 21 oz	Best 26 oz	Seconds 15 oz	Seconds 21 oz	Seconds 26 oz	Thirds 15 oz	Thirds 21 oz	Thirds 26 oz
		s d	s d	s d	s d	s d	s d	s d	s d	s d
Sheet glass under 2 ft super per sq	per ft sup	0 5	0 6	0 7	0 3	0 4	0 5	0 2	0 3	0 4
2 ft to 4 ft		0 6	0 7	0 8	0 4	0 5	0 6	0 3	0 4	0 5
4 ft to 8 ft	,,	0 7	0 8	0 9	0 5	0 6	0 7	0 4	0 5	0 6
Add if ground one side any size		0 1½	0 1½	0 1½	0 1½	0 1½	0 1½	0 1½	0 1½	0 1½
Frosting squares in imitation of ground glass	,,	0 2	0 2	0 2	0 2	0 2	0 2	0 2	0 2	0 2
Add if stopped in new sashes	,,	0 2½	0 2¾	0 3	0 2½	0 2¾	0 3	0 2½	0 2¾	0 3
,, old sashes and hacking out old glass, and painting rebates and putty *one coat*	,,	0 5	0 5½	0 6	0 5	0 5½	0 6	0 5	0 5½	0 6
Add if bedded in chamois leather	,,	0 1½	0 1½	0 1½	0 1½	0 1½	0 1½	0 1½	0 1½	0 1½
Taking out glass and stopping into other sashes as before	,,	0 6	0 6½	0 7	0 6	0 6½	0 7	0 6	0 6½	0 7
Lead lights, plain, in squares under 8 in × 6 in, supplied only	,,	0 11	1 0	1 1	0 10	0 11	1 0	0 9	0 10	0 11
Ditto over 8 in × 6 in ditto	,,	0 9	0 10	0 11	0 8	0 9	0 10	0 7	0 8	0 9
Circular cutting and risk sheet glass	per ft run	0 1	0 1½	0 2	0 1	0 1½	0 2	0 1	0 1½	0 2
Puttying sashes or skylights	,,	0 1	0 1	0 1	0 1	0 1	0 1	0 1	0 1	0 1
Painting rebates	,,	0 0¼	0 0¼	0 0¼	0 0¼	0 0¼	0 0¼	0 0¼	0 0¼	0 0¼
Painting putty (after puttying)	,,	0 0½	0 0½	0 0½	0 0½	0 0½	0 0½	0 0½	0 0½	0 0½

Irregular shaped panes to be measured as square. Fractions of inches to be measured and paid for as whole inches.

ROUGH ROLLED AND FLUTED PLATE GLASS

Description		Hartley's Rough Plate ⅛ in	$\frac{3}{16}$ in	¼ in	⅜ in	½ in	Eleven Flutes per inch ⅛ in	$\frac{3}{16}$ in	¼ in	⅜ in	Four Flutes per inch ⅛ in	$\frac{3}{16}$ in	¼ in	⅜ in
		s d	s d	s d	s d	s d	s d	s d	s d	s d	s d	s d	s d	s d
In squares not over 10 ft. super	per ft. super	0 3½	0 4	0 5	0	0 9	0 4	0 5	0 7	0 9	0 5	0 6	0 8	0 10
Add for glazing in new sashes		0 4	0 4	0 4½	0 4½	0 5	0 4	0 4	0 4½	0 4½	0 4	0 4	0 4½	0 4½
old sashes		0 6	0	0 6½	0 6½	0	0 6	0 6	0 6½	0 6½	0 6	0 6	0 6½	0 6½
Taking out glass from old sashes and stopping into the sashes			0 7	0 [illegible]	0 [illegible]	0 8	0 7	0 7	0 [illegible]	0 7½	0 7	0 [illegible]	0 7½	0 7½
Fixing glass		1	1	1 4	1 6	1 9	1 0	1 2	1 4	1 6	1 0	1 2	1 4	1 0
Cutting [illegible]	per ft. run		1½	1½	[illegible] 1½	0 2	0 1½	0 1½	0 1½	0 2	0 1½	0 1½	0 [illegible]	0 [illegible]

POLISHED AND PATENT PLATE GLASS

Description		British Polished Plate Glazing	Plate (Crystal) [illegible] under 30 [illegible] wide, 1st Quality C [illegible] 1 oz	[illegible]1 oz	[illegible]4 oz	3rd Quality C 1 oz	[illegible]1 oz	[illegible]1 oz
		¼ in						
		s d	s d	s d	s d	s d	s d	s d
In squares under 2 ft. super	per ft. super	1 4	2 10	2 10	2 11½	2 2	2 2	2 3
2 ft. to 4 ft.		1 [illegible]	3 3	3 3	3 5	2 6	2 6	2 7
4 ft. to 6 ft.		1 10	3 8	3 8	3 11	2 9	2 9	3 0
6 ft. to 9 ft.		[illegible] 0	4 1	4 1	4 3½	3 2	3 2	3 4
9 ft. to 12 ft.		2 3	4 4	4 4	4 5½	3 4	3 4	3 6
All [illegible]		0 5	—		—	—	—	—
All [illegible]		1 3	1 0	1 1	1 2	1 0	1 1	1 [illegible]
Add for glazing in new sashes		0 6	0 3½	0 3½	0 4	0 3½	0 3½	0 4
old sashes		0 8	0 [illegible]	0 5½	0 6	0 5½	0 [illegible]	0 6
Cutting [illegible] and [illegible]	per ft. run	0 3	0 [illegible]	0 2½	0 3	0 [illegible]	0 2½	0 3

The largest [illegible] bending plate glass are 1s to 3s per foot super extra according to size and radius of curve

MISCELLANEOUS

		s	d
	per ft sup	0	2
		1	0
		0	9
		4	3
		0	5
		0	6
		0	3
		0	5
Ornamental figured rolled glass white Muranese diaper &c supplied only		0	6½
Ditto ditto tinted ditto		0	9
Ditto ditto pot metal ditto		0	10
Extra if cut to sizes		0	2
Sand blasting floral design in centre of glass		1	0
ses in iron		7	6
		0	9
		0	10
Rendle's Invincible'		0	9
Shelley's Unique		1	0
Cleaning lead lights one side only		0	1
½ in bevelling to glass in squares under 10 f s	per ft run	0	
¼ in		0	9½
Wrought iron saddle bars for lead lights		0	2
Cleaning windows both sides under 2 ft sup	per doz squares	1	0
4 ft		1	6

MATERIALS

(WITHOUT PROFIT)


Glazier's Diamond


Glazier's Hacking Knife


Glazier's Putty Knife

		s	d
Diamond glazier's No 2 size for ordinary sheet	each	18	0
for thick sheet		21	0
	per yard	0	9
	per ft sup	0	1½
		0	
		0	1½
		0	2
Lead tret for window lights	per lb	0	5
Linseed oil raw	per gal	4	0
boiled		4	3
Putty linseed-oil	per lb	0	1½
white or red lead		0	3½
Sprigs or nails iron or steel		0	4
copper		1	6
White lead ground in oil		0	
Whiting best washed in lumps (2s 4d per cwt)		0	0¼

WAGES

		s	d
Wages glazier s	per hour	0	9
„ glazier s labourer		0	6¼

ANALYSIS

Putty —Putty is made of Spanish whiting reduced to a fine powder, kneaded with raw linseed oil to form it into a stiff paste *Hard putty* may be made by substituting turps for part of the oil For *soft putty* mix 10 lbs whiting and 1 lb of white lead with the necessary quantity of boiled linseed oil adding to it ¼ gill of the best salad oil The salad oil prevents the white lead from hardening and keeps the putty in a state sufficiently soft to adhere at all times, not allowing the wet to enter by the material getting hard and cracking off as is often the case with ordinary stiff putty *Thermo plastic putty* contains tallow which keeps it pliable so that it is not loosened by the expansion and contraction of large panes of glass under changes of temperature

Sashes must first be primed before being puttied other wise the wood will draw the oil out of the putty and cause it to shrink and fall out Putty should also be covered with a coat of paint to protect it from the air or it will shrink and get loose as the oil dries out of it by oxidation

Small panes ought to be back puttied and large ones first secured by sprigs before front puttying To resist concussion if glass is in doors it is sometimes bedded on vulcanised indiarubber chamois or wash leather There are many systems of patent roof glazing without putty

Solder — Solder used for lead glazing is the plumber s fine solder, 1 tin to 1 lead

Trade Custom —Glazing is frequently sub let to a glass merchant as fetched primed glazed and delivered This saves risk and is the cheapest plan Low prices are sometimes due to the substitution of glass of less weight and inferior quality to that specified Manufacturers are con stantly combining and issuing new tariffs, as the price lists are termed in the trade till these are broken by the firms who are anxious to get orders when a collapse ensues and a lower tariff is issued Special quotations can be obtained for large orders

Risk of breakage damage and expense of carriage are borne by the purchaser, the glass being usually sent as

"carriage forward" Packing cases, blind frames, and flannel are also charged, but packing cases will be allowed for if returned within one month in good condition and free of expense

Discount —On large quantities of glass there is a trade discount of 20 to 25 per cent For polished plate glass, in sizes up to 12 ft super, the discount is 50 per cent, and over that 40 per cent —*i e*, the larger the panes the smaller the discount

Discount for cash 2½ per cent if paid within one month, and 1¼ per cent if paid in the second month after delivery

Lead Lights —Fret lead for glazing is of H section usually ¼ in or ⅜ in wide, the middle bar being termed the heart and the side the leaf, The latter is either flat round, or bead edged Lead lights are bought ready made Manufacturers charge those under 12 in wide or square as 12 in, and irregular shapes are

Fret Lead

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15 oz *3rds Quality Sheet Glass, in Squares under 2 ft super, and stopped in New Sashes* —Foreign or Belgian sheet glass is the kind usually sold by the middle tradesman, as only about a seventh of the glass used in this country is of British manufacture Belgian is inferior to British It is purchased wholesale per cases of 300 ft for 15 oz of 3rd and 4th qualities, and per cases of 200 ft for all other weights and qualities English sheet glass is sold in crates of so many sheets of stock sizes (see "Memoranda") When packed for the convenience of the buyer in crates of less

of 1s 6d
oz 3rds
ot super

Special quotations can be obtained on application as prices fluctuate so much. An allowance must be made to cover the cost of carriage, risk of breakage and waste in cutting

A glazier will take 15 hour per foot super in stopping large squares in new sashes, but as the squares are here small, and there is cutting to size, say ⅙ hour A glazier will thus cut and stop about 6 ft super per hour

	s	d
	0	1½
	0	0¼
	0	0¼
	0	1½
	0	0¼
	0	3¾
Add 20 per cent profit &c	0	0¾
Price per foot super	0	4½

Glazing in London —A common trade rate in London for customers sashes fetched primed glazed, and delivered, is as follows —

		s	d
Selected 15 oz sheet glass	per ft super	0	2
" 21 oz		0	3
26 oz.		0	3½

Glazing on site—new work, ½d per foot super extra on these prices

NOTE —No allowance can be made for priming executed by the purchaser

Hartley's ⅛ in Rough Plate Glass and Glazing in Squares under 10 ft super —This is packed in crates for cutting up, of the sizes as manufactured Plain rolled—*i e*, with fine lines on the surface—is 3¼*d* per foot super, and the labour is rather more than that for sheet glass

	s	d
1 ft super ⅛ in Hartley's rough plate glass	0	3¼
Carriage and risk of breakage	0	0¼
Linseed oil putty at 1½d per lb	0	0¼
⅛ hour glazier cutting and stopping at 3d	0	2¼
Waste in cutting 10 per cent of cost of glass	0	0¼
	0	6¼
Add 20 per cent profit &c	0	1¼
Price per foot super	0	7½

¼ in Best British Polished Plate Glass and Glazing in Squares 4 to 6 ft super —For polished plate glass in sizes up to 12 ft super the discount is 50 per cent and over that 40 per cent The price list quotation for best glazing quality is 1s 10d per foot super in plates not above 6 ft super, or say 1s deducting the 50 per cent discount for sizes under 12 ft super A few sprigs will be required to hold in the glass *The labour will be a little more than for previous item* Wood beads for fixing come under *Carpenter and Joiner*

	s	d
[illegible]	1	0
	0	0½
	0	0½
	0	1½
	0	3
	0	1
	1	6½
Add 20 per cent profit &c	0	3½
Price per foot super	1	10

The price of polished plate glass is influenced to a considerable extent particularly in the larger squares by the number of superficial feet each sheet contains, consequently in measuring care should be taken to keep the totals of the glass separate according to the different areas of the squares and stating them

Large pieces are more expensive in proportion than small ones owing to increased difficulties of manufacture and irregular or circular shapes are charged as the sizes out of which the glass has to be cut For difficult shapes there is an extra cost for the risk in cutting Bent glass is charged additional according to size and curve Two or three men may be required for glazing big squares of heavy plate

Cleaning Windows both Sides under 2 ft super—The labour constant for this is 04 hour glazier per foot super or 08 as the squares are up to 2 ft super And 08 hour per square of 2 ft super × 12 squares = 96 or, say 1 hour per dozen squares Add flannel and whiting

	s	d
1 hour glazier at 9d	0	9
Flannel and whiting	0	1
	0	10
Add 20 per cent profit &c	0	2
Price per dozen squares	1	0

Muffing Glass—A painter or glazier can muff 7 ft super of glass per hour in squares about 16 in × 10 in by painting one coat white paint and using ¼ lb white lead

	s	d
⅛ lb white lead in oil at 3½*d*	0	0½
1 hour glazier at 9*d*	0	9
	0	9½
Add 20 per cent profit &c	0	2
	7)0	11½
Price per foot super 1 coat	0	1½

For second coat a little less material and labour and add cost to first coat

Other prices in the glazier s trade are easily worked out in a similar manner

Broken Glass —About ½ per cent on the amount of glazier s bill should cover the value of the glass broken on works before final handing over

CHAPTER XXIII.—PAPERHANGER.

MEMORANDA

A piece of En[illegible] × 20 in [illegible]ds The 2[illegible] margins o[illegible] total width is 21 in or 63 ft super Therefore divide superficial area to be covered in feet by 60 to obtain number of pieces A piece as sold however seldom exceeds 11 yards in length

Allow 1 piece in 7 for waste in large patterns and 1 piece in 10 for small patterns The smaller the pattern the less the waste

A double roll of paper is about 16 yards in length whereas a bolt of paper is a roll containing any number of yards over 16 A roll or bolt of canvas = 39 yds run

A piece of French paper varies but is mostly 9 yards long by 18 in wide (net width of pattern) and contains 40½ ft super or 4½ square yards

A piece of Japanese paper is 12 yards long × 1 yard wide

Lining paper is usually 22½ in wide × 12 yards long or 7½ square yards

A dozen of border is 12 yards long or 36 ft run

[illegible] rd run [illegible] hour [illegible] 5 pieces of En[illegible] on per piece

2 lbs or 1 quart wheaten flour
1 oz alum (for strengthening)
3 pints single size (sometimes)
} mixed in 1 gal of boiling water make 1 gal paste

1 lb glue and 1 gal water make 1 gal size

Constants of Labour

		Hours of a paperhanger
Stripping only ordinary papers off walls	per piece	·45
Pumicing sizing 1 coat and preparing walls		1·00
Taking down old paper and washing stopping and preparing old walls for new paper		·75
Sizing walls 1 coat only or clearcolle		·40
Hanging only common papers		·30
satin		1·35
best		[illegible]
ceiling papers extra only		·31
Japanese paper (12 yds × 1 yd)		1·80

WALL PAPER TABLE

Showing net number of English pieces (calculated at 60 ft per piece) required for a room of a given size, without deducting doors, windows, or fireplaces Add $\frac{1}{7}$ or $\frac{1}{10}$ for waste, according to large or small patterns

Girth round Walls	Height of Room from Skirting to Cornice									
	6 ft	7 ft	8 ft	9 ft	10 ft	11 ft	12 ft	13 ft	14 ft	15 ft
Ft	Pieces	Pieces	Pieces	Pieces	Pieces	Pieces	Pieces	Pieces	Pieces	Pieces
30	3	4	4	5	5	6	6	7	7	8
32	3	4	4	5	5	6	7	7	8	8
34	4	4	5	5	6	6	7	7	8	9
36	4	4	5	6	6	7	7	8	9	9
38	4	5	5	6	6	7	8	8	9	10
40	4	5	5	6	7	7	8	9	9	10
42	4	5	6	6	7	8	9	9	10	11
44	5	5	6	7	7	8	9	10	10	11
46	5	6	6	7	8	9	9	10	11	12
48	5	6	7	7	8	9	10	11	11	12
50	5	6	7	8	8	9	10	11	12	13
52	5	6	7	8	9	10	11	11	12	13
54	6	6	7	8	9	10	11	12	13	14
56	6	7	8	9	9	10	11	12	13	14
58	6	7	8	9	10	11	12	13	14	15
60	6	7	8	9	10	11	12	13	14	15
62	6	7	8	9	10	11	13	14	15	16
64	7	8	9	10	11	12	13	14	15	16
66	7	8	9	10	11	12	13	14	16	17
68	7	8	9	10	11	13	14	15	16	17
70	7	8	9	11	12	13	14	15	16	18
72	7	9	10	11	12	13	15	16	17	18
74	8	9	10	11	12	14	15	16	17	19
76	8	9	10	11	13	14	15	17	18	19
78	8	9	11	12	13	14	16	17	18	20
80	8	9	11	12	13	15	16	17	19	20
82	8	10	11	12	14	15	17	18	19	21
84	9	10	11	13	14	16	17	18	20	21
86	9	10	12	13	14	16	17	19	20	22
88	9	10	12	13	15	16	18	19	21	22
90	9	11	12	14	15	17	18	20	21	23
92	9	11	12	14	15	17	18	20	22	23
94	10	11	13	14	16	17	19	21	22	24
96	10	11	13	15	16	18	19	21	23	24
98	10	12	13	15	16	18	20	21	23	25
100	10	12	13	15	17	18	20	22	23	25

PRICES

Papering

		s d		s d
Stripping only ordinary papers off walls	per piece			0 5
				0 10
				0 10
				0 5
Hanging white lining paper including pumicing rubbing smooth and sizing walls				0 9
Hanging only common or plain papers including pumicing and sizing the walls	per piece	0 6	to	1 0
Ditto satin papers ditto		0 9		1 6
Ditto flock and gold papers ditto		1 6		2 6
Ditto embossed papers and decorations		3 0		4 0
Ditto common or flock borders	per doz yds run	0 6		1 0
Ditto friezes up to 12 in deep		0 6		1 0
	per piece			0 4
				0 5
				4 0
				6 0
Sewing and putting up canvas lining including tacks brown paper slips and canvas	per yd sup			1 0
Re straining old canvas and ditto				0 3
Stripping off old canvas and clearing out old nails				0 2
Guttapercha sheets and hanging				0 1

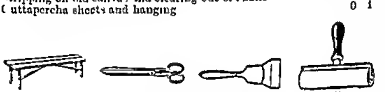


Table   Scissors   Scraper   Roller

Materials

(WITHOUT PROFIT)

		s d		s d
Alum powdered or lump	per lb	0 1½	to	0 2
Canvas best lining	per yd sup	0 5		0 8
Flour fine for paste	per lb	0 1½		0 2
Glue good bright for size only		0 3½		0 4
Japanese wall papers	per piece	15 0		25 0
Lincrusta Walton dadoes 16 in to 27 in wide	per yd run	1 6		6 0
fillings 18 in to 27 in wide		1 3		3 3
friezes 5 in to 23 in wide		0 9		3 0
ceilings 18 in to 21 in wide		1 0		3 6
Lining paper weighing 40 lbs per ream	per piece	0 6		2 0
Paperhangings machine printed pulps		0 6		1 3
grounds		1 0		3 0
satins		1 6		3 0
golds		2 [illegible]		6 0
Hand printed damask grounds		3 0		10 0

MATERIALS—*continued*

		s	d		s	d
Paperhangings, hand printed damasks, satins	per piece	4	6	to	18	0
,, hand printed damasks, micas	,,	6	0	,,	18	0
,, (raised flocks), for painting over	,,	10	0	,,	25	0
,, embossed leather papers	,,	20	0	,,	40	0
,, "Anagtypta," low relief	,,	5	0	,,	35	0
,, Japanese leather papers	,,	18	0	,,	60	0
,, imitation granites, marbles, &c	,,	0	6	,,	2	6
Pitch paper, or indiarubber paper	,,	0	9	,,	2	6
Paper borders, 6 in to 22 in wide	per doz yds run	0	6	,,	1	0
Paper friezes, ditto	,, ,,	3	0	,,	30	0
Paper varnish .	per gal	12	0	,,	14	0
Paste, best flour	,,	1	6		—	
Pumice stone	per lb	0	4		—	
Resin or rosin	,,	0	2		—	
Size best quality	,,	0	3		—	
,, best extra double	,,	0	4½		—	
"Salamander" asbestos decorations, fillings	per ft sup	0	1½	upwards		
,, ,, ,, friezes	,,	0	3	,,		
,, ,, ,, dadoes	,,	0	3	,,		
,, ,, ,, ceilings	,,	0	3	,,		
Tacks black or tinned	per 1,000	0	9		—	
Tinfoil, 1½ oz per ft sup, in sheets 2 ft × 1 ft, and hanging	per ft sup	0	2		—	
Willesden paper, for lining walls 2 ply, 54 in wide ,	per yd run	1	0		—	
Ditto, ditto, 1 ply, 56 in wide	,,	0	6		—	

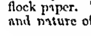
WAGES

		s	d		s	d
Wages, paperhanger's	per hour	0	9		—	
,, paperhanger's labourer	,,	0	6½		—	

ANALYSIS

A few remarks and examples will indicate how the prices in this trade are arrived at, without going into much detail

Paperhangings —There are three kinds of wall paper in ordinary use —viz, common printed papers, satin paper, and flock paper. The value in each case depends on the number and nature of the colours in each pattern, increasing considerably on the introduction of gold The first two kinds are hand printed or machine printed the former is considered the better, and may be known by its finish and by the marks of the pins on the margin used to guide the position of the wood blocks, a separate block being needed for each pattern In the machine printed papers the patterns are engraved on metal rollers—one for each colour required, the paper being printed in continuous bands several hundred yards long



Paste Brush

The descriptions and prices of hand printed and of machine printed papers may be obtained of well known makers like Messrs Jeffrey & Co, Islington, Woollams & Co, Manchester Square, or of wholesale houses such as Messrs Young and Marten, Stratford, or Nicholls and Clarke, Shoreditch

The length and breadth of ornamental and relief decorations vary considerably they are made from 18 to 30 in wide, and almost any length up to 12 yds Ceiling decorations are small

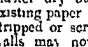
on

sometimes as much as 55 per cent Gross prices are given in the pattern books Some makers of the more artistic there has been a and prices have competition is now

ed for at least a year after a house has been finished, to let the damp in the plaster dry out Before re papering old walls, all the existing paper should first be saturated with water and then stripped or scraped off usually by labourers or boys The walls may now be washed with a disinfectant, such as carbolic acid before re papering

Prior to papering there must be a preparatory rubbing down and pumicing smooth, washing, stopping and preparing of walls, for which reckon $\frac{3}{4}$ hour labour per piece If clearcolled or sized then $\frac{1}{4}$ hour more time per piece

One piece of paper should be trimmed, pasted and hung by a paperhanger in $\frac{3}{4}$ to 1 hour at 9*d* Add paste, &c In



Paper Brush

actual practice the time taken varies according to the care required by the quality of the paper Common papers are difficult to hang well, as they are apt to tear with their own weight when saturated with paste Lincrusta and thick decorations are hung with a thick mixture of glue and paste, generally about one third glue French papers cost a trifle more to hang than English papers

For dadoes the labour i

that for upper surfaces

two heights, as in the ca

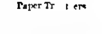
cost of hanging is increased 15 per cent

Hanging small friezes up to 12 in deep is done at the

rate of about 20 yds run per hour. Allow 1 to 3 yds run in 20 ditto for waste in cutting depending on pattern whether running or not.

For papering ceilings add ⅓ hour extra labour per piece over the time for walls.

The trimming of the edges occupies time. In good work papers should be trimmed at both edges and butted. For cheaper style it is customary to cut off one margin of the paper only, the blank strip left on being covered by the next length of paper.



Paper Trimmers

EXAMPLES

Taking Down old Paper.—This is fully described as taking down old paper including stripping, scraping, washing, stopping, rubbing and pumicing smooth and preparing old walls for new paper. Labour ¾ hour per piece.

	s	d
¾ hour paperhanger at 9*d* per hour	0	6¾
Stopping, pumice stone and water, &c	0	1½
	0	8¼
Add 20 per cent profit, &c	0	1¾
Total per piece	0	10

Add if walls are clearcolled or sized 1 coat 5*d* per piece.

Wall Paper, machine printed grounds and hanging.—Allow per piece ¾ hour labour for preparatory pumicing smooth, stopping and preparing walls, say 2s per piece for the paper itself, 1 hour for pasting and hanging including trimming edges and ¼ gallon of paste.

	s	d
¾ hour paperhanger at 9*d* pumicing and stopping	0	6¾
1 piece wall paper machine printed grounds, say	2	0
1 hour paperhanger trimming edges, pasting and hanging	0	9
¼ gallon best flour paste at 1s 6*d* per gallon	0	3½
	3	7¼
Add 20 per cent profit, &c	0	8¾
Total per piece	4	4

CHAPTER XXIV.—GASFITTER.

MEMORANDA

Weight of cast iron spigot and faucet gas pipes —

1½ in	= 0 cwt	1 qr	10 lbs	per 6 ft	length
2 in	= 0 cwt	1 qr	22 lbs	„	„	„
3 in	= 1 cwt	0 qr	0 lbs	„	9 ft	„
4 in	= 1 cwt	1 qr	19 lbs	„	„	„
5 in	= 1 cwt	3 qrs	14 lbs	„	„	„

Weight of wrought iron gas tubing —

⅛ in diam	= 0 cwt	1 qr	0 lbs	per 100 ft run
¼ in „	= 0 cwt	1 qr	13 lbs	„
⅜ in „	= 0 cwt	2 qrs	5 lbs	„
½ in „	= 0 cwt	3 qrs	3 lbs	„
¾ in „	= 1 cwt	0 qr	6 lbs	„
1 in „	= 1 cwt	3 qrs	0 lbs	„
1¼ in „	= 2 cwt	1 qr	10 lbs	„
1½ in „	= 3 cwt	3 qrs	7 lbs	„
2 in „	= 4 cwt	0 qr	0 lbs	„
3 in „	= 8 cwt	1 qr	0 lbs	„

Weight of composition gas tubing —

¼ in diam	= 11 to 13 ozs	per yard run
5/16 in „	= 14 „ 16 ozs	„
⅜ in „	= 18 „ 21 ozs	„
7/16 in „	= 23 „ 26 ozs	„
½ in „	= 29 „ 34 ozs	„
⅝ in „	= 44 „ 52 ozs	„
¾ in „	= 52 „ 68 ozs	„
⅞ in „	= 64 „ 76 ozs	„
1 in „	= 80 „ 88 ozs	„

Composition gas tubing is made from a mixture of tin, lead and antimony, in 50-yard lengths or in ½ or 1 cwt coils

Weight of block tin gas tubing —

¼ in diam	= 8 ozs	per yard run
5/16 in „	= 9½ ozs	„
⅜ in „	= 11 ozs	„
7/16 in „	= 14 ozs	„
½ in „	= 17 ozs	„
⅝ in „	= 23 ozs	„
¾ in „	= 30 ozs	„
[illegible]	[illegible]	„
		„
		„

PRICES

C I Spigot and Faucet Pipes

Description		1½ in		2 in		3 in		4 in	
		s	d	s	d	s	d	s	d
Pipes in 6-ft lengths, including one lead joint per length, and fixing (but not digging)	per ft run	0	8	0	10	—		—	
Ditto, in 9 ft lengths, ditto	per ft run	—		—		1	0	1	6
Add for additional lead joint	each	1	0	1	2	1	5	1	10
Extra for socket branches, and two lead joints	„	2	6	3	3	4	6	6	0
Ditto tees ditto	„	2	6	3	3	4	6	6	0
Ditto bends, and one joint	„	1	5	1	9	2	9	3	9
Ditto caps, collars, plugs, ditto	„	1	2	1	6	2	0	3	0
Cast iron siphons for mains	„	15	0	19	0	24	0	30	0
Stand pipes and caps for siphons all ¾ in, and connecting with siphon	„	4	0	4	0	4	0	4	0
C I covers and frames, and siphon traps let in	„	7	0	7	0	7	0	7	0
Carter's or other approved safety gas valves, with sockets or flanges	„	30	0	39	0	52	0	68	0
Cutting cast iron main	„	1	6	2	0	3	0	4	0

Stout Welded Gas Pipes, &c

(TRADE DISCOUNT DEDUCTED)

Description		¼ in		⅜ in		½ in		¾ in		1 in	
		s	d	s	d	s	d	s	d	s	d
W I black Pipes, up to 12 ft lengths s o	per ft run	0	1¼	0	2	0	2½	0	3	0	3½
Add if fixed, joints, &c	„	0	1¼	0	1½	0	2	0	2½	0	3
Add if galvanised		0	0¼	0	0½	0	0½	0	0½	0	1¼
Extra for short pieces, under 1 ft, with screws s o	each	0	2	0	2½	0	3	0	4	0	5
Ditto connecting pieces or long screws, 12 to 23½ in, s o		0	3	0	4	0	5	0	6	0	7
Ditto bends, elbows and springs	„	0	2½	0	3	0	4	0	5	0	6
Ditto tees equal or diminishing		0	2½	0	3	0	3½	0	4½	0	5
Ditto bends made in pipes	„	0	4	0	5	0	6	0	7	0	8
Ditto crosses, equal or diminishing outlets s o.	„	0	5	0	5½	0	7	0	8½	0	11
Ditto sockets, caps nipples, back nuts, plugs, &c, s o	„	0	1½	0	1½	0	2	0	2½	0	3
Brass unions for iron pipes	„	0	4	0	5	0	7	0	10	1	1
Add to last eight items if fixed	„	0	2	0	2½	0	2½	0	3	0	3½
Iron main cocks screwed	„	1	0	1	4	1	8	2	0	4	0

Stout Welded Gas pipes, &c —*continued*

Description		¼ in s	¼ in d	⅜ in s	⅜ in d	½ in s	½ in d	¾ in s	¾ in d	1 in s	1 in d
Carter's, screw-down valve for iron, with union	each	2	6	3	0	4	10	6	3	8	6
Siphon boxes, complete, one quart, with plugs, s o	..	—		—		6	6	6	9	7	0
Ditto, two quarts ditto	.	—		—		—		8	0	8	9
Add to last four items if fixed	..	—		—		0	7	0	9	1	0
Taking down old gas-pipes and removing to store	per ft	0	0¾	0	0¾	0	1	0	1	0	1
Taking down, cleaning, and re fixing pipes with joints	..	0	2¼	0	2½	0	3	0	3½	0	4
Cutting pipes for alterations or additions including tapping and screwing both ends	each	0	9	0	10	1	0	1	3	1	6
Deduct 10 per cent if butt welded pipes and fittings are used instead of lap welded											
Unions for iron pipe and fixing	..	0	5½	0	7	0	9	1	0	1	4
Ditto tinned ditto	..	0	4	0	5	0	6	0	9	1	1
Universal swivels for iron pipe and fixing	..	1	6	1	9	2	9	—		—	
Cocks stop brass, and fixing	.	1	2	1	4	1	6	1	10	—	
Ditto pillar for iron pipe, ditto	..	0	10	1	0	1	2	1	4	1	6
Ditto brass ditto	.	0	10	0	11	1	2	1	8	1	10
Ceiling plates iron sizes, and fixing with screws	..	0	10	1	0	1	3	1	7	2	0
Ditto brass sizes, ditto	.	0	11	1	1	1	4	1	8	2	0

Small Pipes

Description		¼ in s	¼ in d	⅜ in s	⅜ in d	½ in s	½ in d	¾ in s	¾ in d
Tin pipes of best block tin including bends soldered joints, hooks, &c , and fixed complete	per ft run	0	6	0	8	0	10	1	0
Composition ditto ditto	.	0	3½	0	4	0	4½	0	5
Copper pipe with brazed joints, ditto	per ft run	0	6	0	9	1	0	1	3
Brass ditto ditto	..	0	6	0	9	1	0	1	3
Brass union couples, and ditto	each	0	8	0	10	1	0	1	2
. .. tee pieces ..	..	1	3	1	6	1	9	2	0

Miscellaneous

			s	d
Brass gas brackets	single jointed ½ in × 12 in. s o	each	2	0
..	double jointed ½ in × ⅜ in × 21 in	..	4	0
.	stiff ⅜ in × 12 in. s o .	..	3	0
N I ..	single jointed ⅜ in × 15 in. s o	..	4	0
.	double jointed ½ in × ⅜ in × 4 in	..	7	0

MISCELLANEOUS—*continued*

		s	d.
W I gas brackets, stiff, ½ in × 12 in , s o	each	3	0
Add for fixing foregoing gas brackets	,,	1	6
Gas brackets taken down and removed to store	,,	0	9
[illegible]	,,	1	0
[illegible] in , s o	,,	5	0
[illegible] ½ in , s o		6	0
[illegible]		9	0
[illegible] ,, [illegible] d light, ½ in × ⅜ in s o		13	0
[illegible]		2	0
[illegible]		1	0
[illegible] ad sol	per ft run	0	7
[illegible]		0	9
[illegible] hoods for ditto 1½ in and 2 in tubes	each	1	6

GAS METERS

		£	s	d
Thomas Glover & Co s gas meter for 5 lights dry s o	each	1	16	6
,, 10		2	7	0
,, 20		3	5	0
,, 30		4	10	0
,, 40		5	10	0
,, 50		6	5	0
,, 100		13	15	0
Fixing only gas meters 2 to 10 lights with joints		0	3	0
,, 20 to 60		0	4	0
,, 60 to 100		0	7	0
Charge for stamping 10 to 60-light meters		0	1	0
The 'Stott' mercurial gas governor ½ in 10 lights, s o		1	10	0
The 'Stott' mercurial gas governor ¾ in 1[illegible] lights s o		2	16	6
The 'Stott' mercurial gas governor 1 in 35 lights, s o		3	16	6
The 'Stott' mercurial gas governor 1¼ in 70 lights s o		4	19	0
The 'Stott' mercurial gas governor 1½ in [illegible]0 lights, s o		5	19	0
The 'Stott' mercurial gas governor 2 in 150 lights, s o		8	11	6

MATERIALS

(WITHOUT PROFIT)

		s	d
Burners, bat s wing or fish tail common	gross	10	0
,, Argand chimney holders	each	2	11
,, moon holders		2	4
,, the 'Holborn' flat flame governor		0	8
Sockets for burners, straight		0	3
,, ,, elbow or knee		0	4½
Chimney glasses up to 8 in high		0	3
,, ,, for Argand burners		0	4

MATERIALS—*continued*

		s	d
	each	0	9
		2	0
	per in diam	0	1½
	per lb	0	6
		1	6
	per ft run	0	8
	each	0	9
		1	6
		1	2
brass sizes		1	3
Cocks [illegible]		1	5
		0	10
		12	6
		13	6
Glycerine	per lb	1	10
Red or white lead ground in oil		0	9½
Solder hard (2 copper 1 zinc)		1	0
Talc		12	0
Tubing brass		1	3
composition		0	6
copper		1	4
block tin		1	9

WAGES

		s	d
Wages gasfitter's	per hour	0	9½
gasfitter's labourer	„	0	7

ANALYSIS

Material—The best material that can be used for gas services is welded wrought iron barrel, or tubing generally used in the black state though galvanised tubing is better The tubes are manufactured in lengths from 2 ft to 12 or 14 ft and in short lengths from about 3 in up to 2 ft, for a single light the smallest bore should not be less than ⅜ in W I gas pipes ought to withstand a test of not less than 50 lbs per square inch by hydraulic pressure Composition pipes are unreliable and dangerous, and their only advantage is the ease with which they can be run round awkward bends or curves

Fixing—Gas tubing must always be accessible, or be in sight, and not imbedded in plastering, and if under floors the boards above should have brass cups and screws, and small trap openings ought to be provided Tubing is fixed with wall hooks or patent clips All pipes should be laid to certain falls to allow the condensed water to be drained off at convenient points and for this purpose screwed plugs are provided especially below vertical main near meter, with a tee piece

Discount —The trade discount off list prices of iron gas ... from list prices of ... rosses &c, an addi... ...ount for cash of $2\frac{1}{2}$ per cent The trade discount off catalogue rates of gas fittings is usually retail 25, and wholesale 50 per cent

Cost per Light —The cost of gas lighting inside buildings (as given by Coleman), including service pipes, stopcocks, ordinary brackets, pendants and other articles, fixed complete, but *excluding* meters and external gas mains is roughly as follows Special or superior fittings will entail greater expense

Factories warehouses &c	20s per light
Shops and offices	30s
Houses and villas	40s
Hotels, mansions &c	50s
Barracks including gas main from boundary wall	50s
	33s per head
Gas piping only in new buildings	15s per point
old	20s

A builder will frequently carry out domestic gas work at an agreed rate of 6s to 10s per point, including piping fittings, &c It is sometimes sub let or a separate contract made, or a provisional amount is inserted in the bill of quantities and the articles selected from a catalogue by the architect If the latter method, add carriage fixing and profit

Labour and Attendance —In this trade labour is about 25 per cent and materials 75 per cent in proportion To assist the gasfitter, a boy sometimes takes the place of a labourer

Attendance must be remembered, including cutting away and making good by other workmen, for which allow 5 per cent on gasfitter s bill

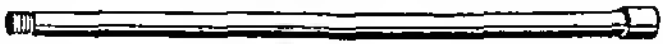
... ones, or the

... net A length of 10 ft will be convenient for analysis, with joints, pipe hooks, and

Pipe Hook.

1¼ hours gasfitter and labourer For the joints equal parts of red lead and white lead ground in linseed oil, form a much used cement Gas hooks are placed 2 ft apart and strong machine made iron ones cost—

¼ in	⅜ in	½ in	¾ in	1 in	1¼ in	1½ in	2 in	
s d	*s d*	*s d*	*s d*	*s d*	*s d*	*s d*	*s d*	
1 10	2 2	2 10	4 2	5 4	7 0	9 0	13 0	per gross



Wrought Iron Gas Pipe

	s	*d*
10 ft run ¾ in galv W I gas pipe at 2¼*d* per ft	1	10½
3¼ ozs red and white lead in oil at 3½*d* per lb	0	0¾
5 strong iron ¾ in pipe hooks at 4*s* 2*d* per gross	0	1¾
1¼ hrs gasfitter and labourer at 9½*d* and 7*d*	2	0¾
	4	1¾
Add 20 per cent profit &c	0	10¼
Price per 10 ft run	10 5	0
Price per ft run	0	6

Bends elbows tees, &c are best stated and measured separately, but if lumped with the straight piping add 50 per cent of the net cost of latter to cover such extras Cutting holes and restoring walls, floors, ceilings &c by other tradesmen will be additional as already stated

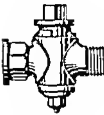
Extra [illegible] 10 to
23½ *in*

Connecting Piece or Long Screw

¾ in long screws is 1*s* 5*d* each, less 65 per cent discount (11*d*) for galvanised = 6*d*, less 2½ per cent discount (¼*d*) for being a fitting = 5¾*d* net From this deduct the piece of say 1½ ft run (the connecting piece being 12 to 23½ ins long) of ¾ in straight piping at 2¼*d* per ft, net Add red and white lead joints, extra hooks, and a ¼ hour more labour

	d
¾ in connecting piece or long screw 12 to 23½ in net	5¾
Deduct 1½ ft run of ¾ in straight piping at 2¼*d* net	3¼
Extra only for connecting piece or long screw net	2½
¼ ozs red and white lead in oil at 3½ per lb	0¼
½ extra strong iron ¾ in pipe hooks at 4*s* 2*d* per gross	1
¼ hr gasfitter and labourer at 9½*d* and 7*d*	4
	8
Add 20 per cent profit &c	1½
Price of each extra only	9½

¾ in Iron Main Cock screwed with Square Head and Fixed.—These have either square heads with separate wrought keys or spanners or else tee heads with the keys fixed on The stopcock may have one male screw end and one female screw end M and F to suit wrought iron gas pipe In the analysis add key, red and white lead joints and ⅓ hour gas fitter and labourer fixing As the discount here goes to the builder it has not been deducted Catalogue prices are —



Iron Main Cock

Iron Key

	⅜ in		½ in		¾ in		1 in		1 in		1¼ in		1½ in		
	s	d	s	d	s	d	s	d	s	d	s	d	s	d	
Square Head		6	9	6	1	6	18	0	3	0	64	0	1 0	0	per doz
Tee Head	8	9	10	6	12	6	19	0	33	6	78	0	150	0	
Wrot. Iron Keys		0		6	3	0	4	0	6	0	8	0	10	0	

	s	d
	1	6
	0	4
	0	0¼
	0	5¼
	2	3¾
Add 20 per cent profit &c	0	5¼
Price of each	2	0

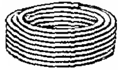
¾ in Carter's Screw-down Valve for iron pipes and Fixed.—This may or may not have a union for connecting up and the valves are made for either iron or brass pipes For fixing add 1¼ ozs red and white lead cement for joints and ¼ hour gasfitter and labourer The catalogue rates appear—

Carter's Valve with Union

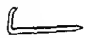
	½ in		¾ in		1 in		1¼ in		
	s	d	s	d	s	d	s	d	
For iron without union	1	0	23	8	39	6	50	0	per doz
For brass	18	0	20	8	2	0	39	6	
For iron with union	25	6	29	4	50	0	61	4	
For brass	20	6	24	0	25	6	50	0	

	s	d
¾ in Carter's valve for iron with union at 61s 4d per doz	5	1¼
1¼ ozs red and white lead in oil at 3½d per lb	0	0¼
¼ hr gasfitter and labourer at 9½d and 7d	0	8¼
	5	9¾
Add 20 per cent profit &c	1	2¼
Price of each	7	0

½ in Composition Gas Tubing, and Fixed—This is composed of tin, lead, and antimony, and known as white metal It is sold in varying lengths of 20 to 50 yds, depending on diameter, and in coils of ½ or 1 cwt The weight of ½ in piping is 2 lbs 2 ozs per yd run For analysing take 10 ft, and allow 2½ ozs hard solder for jointing about 4½ lbs or $\frac{1}{25}$th cwt, coals for fuel in melting the solder 5 pipe hooks 2 ft apart, and about 1 hour gas fitter and labourer Machine made compo pipe hooks, short and long sizes, are given at—



Con po Tube



Pipe Hook

	¼ in	⅜ in	½ in	⅝ in	¾ in	⅞ in	1 in	
	s d	s d	s d	s d	s d	s d	s d	
Pipe hooks short	1 1	1 [illegible]	1 [illegible]	1 [illegible]	2 0	[illegible] 1[illegible]	3 6	per gross
long	1 3	1 [illegible]	1 8	1 11	[illegible] 3	3 1	3 [illegible]	

	s	d
10 ft [illegible] compo [illegible] at 4½d per yd	1	3
[illegible]	0	2
[illegible]	0	0½
[illegible] gross	0	0½
[illegible]	1	4½
	3	10½
Add 20 per cent profit &c	0	7
Price per 10 ft run	10)3	5½
Price per ft run	0	4

Gas Burners Gas burners are of about six main types (with variations in between), and have the gas consumption and candle power indicated below —

		c f		c p
1	Rat tail or single jet (one hole) consuming	1 to 3	per hour	= 2 to 4
2	Fish tail or union jet (two holes)	4 to 5	,,	= 5 to 6
3		5 to 6	,,	= 12 to 16
4		6 to 10	,,	= 20 to 35
5		1 to 4	,,	= 30 to 100
6		1 to 3	,,	= 20 to 70

Rat tail Burner

Fish tail Burner

Batswing Burner

Argand Burner

Upright Incandescent

Inverted Incandescent

Large burners and low pressures give better and cheaper light and brilliancy increases with temperature Incandescent mantles (of rare earth) improve the illumination and reduce the cost immensely, so that with a consumption of only 5 f c. gas per hour a light equal to 100 or 150 candle power may be obtained

The Welsbach Kern is the best known vertical incandescent burner, and does not need a glass chimney—only a globe No 2 size consuming $2\frac{1}{4}$ cub ft of gas per hour with a light of 50 candles, would cost per annum of 1 500 burning hours —

With gas at 2s 6d per 1 000 cub ft	8s 5d per burner per annum
3s 0d	10s 2d
3s 6d	11s 10d
4s 0d	13s 6d
4s 6d	15s 2d
5s 0d	16s 11d

Or less than half the cost with an ordinary batswing burner consuming 5 cub ft of gas per hour with a light of 16 candles not to mention over three times the amount of illumination

TABLE OF WELSBACH KERN BURNERS

(CATALOGUE PRICES)

Size	Gas Consumption per hour	Candle Power (about)	Burners only: With Sheath	With Protector Holder	With Globe Ring	Stripped without Glass Holder
No	cub ft	c p	s d	s d	s d	s d
0	$\frac{3}{4}$	20	3 4	—	—	2 6
1	$1\frac{1}{4}$	30	3 4	—	2 11	2 6
2	$2\frac{1}{4}$	50	3 4	3 1	2 11	2 6
3	3	75	4 0	3 10	3 7	3 2
4	4	100	5 4	4 9	4 6	4 0

Extras—Bye pass 1s 8d Bye pass with double levers and chains 2s 2d Gas regulators for Nos 2 and 3 burners, 6d each and for No 4 1s each Air adjusters (which are not the same as gas regulators) are fitted without extra charge if specified when burners are ordered if not then 8d per dozen

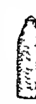
There are also Welsbach C Burners with heavy cast nipple and steatite head ring Consumption about $3\frac{3}{4}$

cub ft of gas per hour, and lighting power averages 60 candles

"Gem" ($1\frac{3}{4}$ f c gas per hour, and 40 c p), and "Simplex" (4 f c gas per hour, and 80 c p) are other varieties

Fittings and accessories are far too numerous to mention

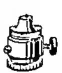
Welsbach Kern Burner with Bye pass.



Upright Mantle

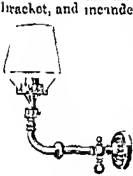
Rod with Clip

Air Adjuster



Gas Regulator

Gas Bracket with upright Burner, Mantle and Globe, and Fixed.—The annexed figure illustrates a usual form of gas bracket, and incandescent upright burner, mantle, &c. The analysis takes all the parts separately for the sake of better information though in practice most of them would be got under an inclusive quotation. Prices would be cheaper than the catalogue rates shown, as the discount is up to 50 per cent, and if purchased wholesale per gross the cost would be proportionately less than by the dozen. Mantles are single or double knitted, 1 ply or 2 ply ramie thread, or Plaissetys mantles



Gas Bracket with Upright

or props must be provided for central support (sometimes with "Firma" clips), sold retail by the gross, and wholesale by the thousand. No glass chimney is necessary, but only a globe

	s	d
No 2 ordinary Welsbach Kern burner with sheath, which includes globe holder, gallery, or ring (and air adjuster)	3	4
Add for brass gas regulator	0	6
Carried forward	3	10

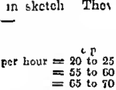
	s	d
Brought forward	3	10
Adapter heavy cast, for connecting burner to bracket, at 10d per doz.	0	0¾
[illegible] doz	0	6[illegible]
[illegible]	0	0½
[illegible]	0	9½
[illegible] gas bracket, [illegible]	5	0
[illegible] ⅞ in thick, moulded on edge and grooved and bored for barrel of gas pipe, at 52s per gross	0	4½
4 brass screws, 2 in , for fixing back to block at 24s per gross	0	8
Price of materials only, total	11	3½
Fixing, 1 hr gasfitter and labourer at 9½d and 7d	1	4½
	12	8
Add 20 per cent profit, &c	2	6
Price of each	15	2

If other articles are required, such as bye pass shade, reflector, smoke top smoke consumer heat disperser or heat shield chain ceiling hook and rose &c they must be added to make up the total cost

Inverted Burner including Mantle and Globe, and Fixed —There are many sorts of inverted incandescent gas burners, but a common swan neck type is shown in sketch They illuminate well at little cost, and consume—

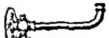
	in		f c		c p
Bijou size	with 1⅞	flange fitting burns	1	gas per hour	= 20 to 25
Medium size	2⅞		2½		= 55 to 60
Full size	3$\frac{1}{16}$		3		= 65 to 70

The following detail includes burner which can be attached to any existing fitting whether incandescent or not by means of an adapter, air adjuster gas regulator, mantle (single knitted double knitted, or 3 lock ramie fabric) and globe The latter are of endless patterns, with clear, opaline, opal and flint, fluted, etched, tinted, &c glass Anybody can screw on the swan neck in a few minutes Prices are catalogue


Inverted Burner and Mantle

rates, and subject to trade discount as before If shade smoke top, &c are desired then add

	s	d
Medium size polished brass or steel bronzed inverted burner		
	1	6
	0	2
	0	7
7d per doz	0	0¼
Inverted mantle double knitted ramie, at 5s per doz	0	5
Opaline globe, plain at 5s per doz	0	5
Price of materials only	3	1¼
Fixing say ¼ hr gasfitter at 9½d	0	2¼
	3	4
Add 20 per cent profit &c	0	8
Price of each	4	0



Stiff Bracket.

Opaline Shade

Adapter

Bye pass for Inverted Burners

Magnesia Nozzle

Inverted Mantle

Gas Regulator for Inverted L

APPENDIX.

MISCELLANEOUS MEMORANDA

Triangles

Area $= \frac{1}{2}$ base $\times$ perpendicular, or
Area $= \sqrt{s(s-a)(s-b)(s-c)}$ where a, b, and c represent the sides, and s half their sum

Square, Rectangle, Rhombus, or Rhomboid

Area $=$ base $\times$ perpendicular height

Circle

Circumference $= 3.1416$ diameter, or say $\frac{22}{7}$ diameter
Diameter $= 0.3183$ circumference, or say $\frac{7}{22}$ circumference
Area $=$ diameter^2 $\times$ .7854, or say diameter^2 $\times$ $\frac{11}{14}$
Area $= \frac{1}{2}$ diameter $\times$ $\frac{1}{2}$ circumference

Sector of a Circle

Area $=$ radius of a circle $\times$ $\frac{1}{2}$ arc
Area $= \dfrac{\text{degrees in arc} \times \text{area of circle}}{360}$

Cone

Solidity $=$ area of base $\times$ $\frac{1}{3}$ height

Ellipse

Circumference $= \frac{1}{2}$ major axis $+$ $\frac{1}{2}$ minor axis $\times$ 3.1416
Area $= \frac{1}{2}$ major axis $\times$ $\frac{1}{2}$ minor axis $\times$ 3.1416

Cylinder

Surface $=$ circumference $\times$ length $+$ 2 area of base
Solidity $=$ diameter^2 $\times$ .7854 $\times$ length

Sphere

Surface $=$ diameter^2 $\times$ 3.1416
Solidity $=$ diameter^3 $\times$ .5236

Parabola

Area $=$ base $\times$ $\frac{2}{3}$ height

Regular Polygons

Area $=$ half sum of sides $\times$ perpendicular drawn from centre

Pyramid

Solidity = area of base × ⅓ height

Prism

Solidity = area of end × length

Trapezium

Area = ½ sum of parallel sides × vertical distance apart

Long Measure

12 inches = 1 foot	40 perches = 1 furlong
3 feet = 1 yard	8 furlongs = 1 mile
6 feet = 1 fathom	1 760 yards = 1 mile
5½ yards = 1 rod, pole, or perch	3 miles = 1 league
Metre = 39.37 inches	Kilometre = 1 093.62 yards

Square Measure

144 square inches	= 1 square foot
9 feet	= 1 yard
30¼ yards	= 1 perch
40 perches	= 1 rood or 1 210 y. s.
4 roods or 4 840 y. s.	= 1 acre or 10 sq. chains
640 acres English	= 1 square mile

Solid Measure

1 728 cubic inches	= 1 cubic foot
27 feet	= 1 yard

Contents of Casks

9 gals. = 1 firkin	54 gals. = 1 hogshead
18 = 1 kilderkin	108 ,, = 1 butt
36 = 1 barrel	216 ,, = 1 tun

1 bushel = 4 pecks = 8 gals. (dry measure)

Liquid Measure

4 gills = 1 pint	63 gallons = 1 hogshead
2 pints = 1 quart	1⅓ hogshead = 1 puncheon
4 quarts = 1 gallon	1½ puncheons = 1 pipe
42 gallons = 1 tierce	2 pipes = 1 tun

Avoirdupois Weight

16 drams = 1 ounce	28 pounds = 1 quarter
16 ounces = 1 pound	4 quarters = 1 cwt
14 pounds = 1 stone	20 cwt (2 240 lbs.) = 1 ton

Paper

24 sheets = 1 quire	2 reams = 1 bundle
20 quires = 1 ream	10 „ = 1 bale

Drawing Paper

	in in		in in
Emperor	72 × 48	Elephant	28 × 23
Antiquarian	53 × 31	Super royal	27 × 19
Double elephant	40 × 26¾	Royal	24 × 19
Atlas	34 × 26	Medium	22 × 17½
Colombier	34½ × 23½	Demy	20 × 15½
Imperial	30 × 22	Foolscap	17 × 13½

Water

1 gal of water = 10 lbs	1 ton of water = 36 ft cube
1 ft cube = 62½ lbs	1 „ = 1⅓ yds cube
1 ft „ = 6¼ gallons	1 „ = 224 gallons

Coal

Anthracite coal weighs	55 to 60 lbs per ft cube
Bituminous	50 to 53 lbs
Newcastle	about 50 lbs
Welsh	54 lbs

Coke

1 sack	= 4 bushels
1 chaldron	= 12 sacks
1 score	= 21 chaldrons
1 ft cube	= 46 lbs

Miscellaneous

12 dozen = 1 gross	A faggot of steel = 120 lbs
A firkin = 1.44 ft cube	A pig of ballast = 56 lbs
A barrel = 5 „	A fodder of lead = 2 184 lbs
A bushel = 1¼ „	A ton of freight = 40 ft cube

A ton of coal occupies	45 cubic feet
„ coke	49 „
„ hay	500 „
„ straw	1 1[illegible]0 „

Rainfall

Average rainfall of United Kingdom = 32 in per annum
1 in rainfall = 22 623 gals per acre
= 3 630 ft cube per acre

Horse-Power

Horse power (H P) = 33 000 lbs raised 1 ft high per minute
or = 550 lbs „ „ second

Drain Pipes

Internal Diameter	Net length when laid	Thickness of Pipe	Thickness of Socket	Depth of Socket	Weight per Pipe
4 in stoneware	2 ft	$\frac{1}{2}$ in	$\frac{1}{2}$ in	$1\frac{1}{2}$ in	18 lbs
6-in "	2 "	$\frac{11}{16}$ "	$\frac{11}{16}$	$1\frac{3}{4}$ "	32 "
9 in "	2 "	$\frac{13}{16}$ "	$\frac{13}{16}$ "	2 "	58 "
4 in cast iron	9 "	$\frac{3}{8}$ "	$\frac{3}{8}$ "	4 "	$1\frac{1}{2}$ cwt
6-in	9 "	$\frac{7}{16}$ "	$\frac{1}{2}$	$4\frac{1}{2}$ "	$2\frac{1}{4}$ "
9 in "	9 "	$\frac{17}{32}$ "	$\frac{9}{16}$ "	$4\frac{1}{2}$ "	$4\frac{1}{2}$ "

Fall

Rule —Multiply diameter of pipe in inches by 10, and the result will give self cleansing gradients Thus —

Fall of 4 in	pipe should be	1 in 40
" 6-in	"	1 in 60
" 9 in	" "	1 in 90

Self cleansing gradients mean a velocity of 3 to 4 ft per second when the depth of sewage is $\frac{1}{4}$th diameter of pipe, which is reckoned as the normal quantity ordinarily passing through domestic drains

The maximum discharge, however, is obtained when the depth of the flow is about $\frac{15}{16}$ths diameter of pipe, and not when flowing full as might be supposed

Pipe Tests

The following tests are usually specified, the rule being a head of 1 ft = a pressure of ·433 lb per square inch —

	Head of Water		
Stoneware drain pipes to a	10 ft, or	$4\frac{1}{4}$ lbs	per square inch
Cast iron "	200 ft, "	87 lbs	"
Wrought iron gas pipes to a	120 ft, "	52 lbs	"
Cast iron "	300 ft, "	130 lbs	"
Wrought iron water pipes to a	400 ft, "	173 lbs	
Cast iron	600 ft, "	260 lbs	

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